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NOTES AND COMMENTS

Sugar Surcharge Re-imposition.

The Ministry of Agriculture, Fisheries and Food announced on 19th February that from the following day, distribution payments on sugar would cease and the Sugar Board would instead levy a surcharge. Surcharge repayments, payable by the Sugar Board were also re-introduced on and from 20th February on goods which had become entitled to drawback of sugar duty (e.g. on export) and on which surcharge has been paid. The rates of surcharge or sugar and molasses are shown below.

SURCHARGE RATES FOR SUGAR.

Polarization				*Rate of Surcharge per cwt of sugar.*	
Exceeding				s	d
99°				11	8
98°	but not exceeding		99°	11	0·0
97°	"	"	98°	10	8·8
96°	"	"	97°	10	5·4
95°	"	"	96°	10	2·0
94°	"	"	95°	9	10·7
93°	"	"	94°	9	7·3
92°	"	"	93°	9	4·0
91°	"	"	92°	9	0·6
90°	"	"	91°	8	9·2
89°	"	"	90°	8	5·9
88°	"	"	89°	8	2·5
87°	"	"	88°	7	11·7
86°	"	"	87°	7	8·9
85°	"	"	86°	7	6·4
84°	"	"	85°	7	3·9
83°	"	"	84°	7	1·4
82°	"	"	83°	6	10·8
81°	"	"	82°	6	8·6
80°	"	"	81°	6	6·4
79°	"	"	80°	6	4·1
78°	"	"	79°	6	1·9
77°	"	"	78°	5	11·6
76°	"	"	77°	5	9·4
Not exceeding 76°				5	7·2

SURCHARGE RATES FOR MOLASSES

Sweetening matter content	*Rate of Surcharge per cwt*	
	s	d
70 per cent or more	7	5
Less than 70 per cent and more than 50 per cent	5	4
Not more than 50 per cent	2	7

The distribution payment which has now ceased was equivalent to about ½d. per lb on refined sugar. The surcharge now started is equivalent to about 1⅜d per lb on refined sugar so that from the 20th February, subject to the market fluctuations in the price of raw sugar, the first-hand selling price of refined sugar in the home trade became about 1¾d per lb higher as a result of these changes.

It will be remembered that the surcharge of about ⅛d per lb on refined sugar was levied when the Sugar Board started operations in January 1957. As a result of the profits accumulated because of the rise in the free market price of sugar, distribution payments have been made from July 1957. The fall in the world price of sugar coupled with the distribution payments has led to losses which the new surcharge is intended to cover.

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Indian Sugar Exports.

Exports of Indian sugar during 1957 totalled 146,749 metric tons, made up as follows :

Iraq	13,085
Saudi Arabia	1,247
Aden	8,050
Zanzibar	2,445
Bahrein	2,637
Muscat	398
Dubai	841
Ununsaid	1,169
Kenya	21,920
Sudan	14,847
Malaya	19,839
Singapore	5,096
China	33,549
Ceylon	8,158
Burma	11,643
U.K.	1,002
North VietNam	823
	146,749

On the Indian Government export policy, C. Czarnikow Ltd. comment[1]:

"The Indian Government's decision regarding her export policy is awaited with a great deal of interest. We understand that both the Government and the industry speak with one voice as to the necessity for exports, but the method by which the gap between home production costs and World

[1] *Sugar Review*, 1958, (342), 37.

Market values is to be bridged is still a very controversial subject.

"With a production last season of 2,026,000 tons white sugar, and the possibility of the target of 2,250,000 tons being exceeded, the question of exports is an important one. There is, of course, the hope that domestic consumption in India will continue to expand and may eventually render the matter of exports a less urgent one. In the meantime, however, stocks are above the level deemed to be necessary ; from the total at the end of the fiscal year November/October 1956/57 of 475,000 tons, the stock has risen to 627,000 tons as at 31st December 1957."

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West Indies Sugar Corp. 1957 Report.

The unrestricted 1957 crop in Cuba enabled the Company to demonstrate its true production potential in Cuba and the favourable financial results achieved were a reflection not only of higher world prices but of the reduced overhead costs resulting from full production. Cane ground in Cuba amounted to 2,387,016 short tons (1,383,448 in 1956) yielding 12·70 sugar % cane (12·99) with a total outturn of 303,252 short tons 96° sugar (179,720). Molasses produced amounted to 11,076,458 U.S. gallons (6,770,198 in 1956).

In November 1956 the Company was informed by Azucarera Haina C. por A., the largest Dominican sugar producer, that it would welcome discussions and negotiations that might lead to its acquisition of all the properties owned by Dominican subsidiaries of the West Indies Sugar Corp. Negotiations led to the sale of the properties for $35,830,000 which is considered a fair price. The Corporation is finally relieved of the difficult and embarrassing problem that it has always faced of reconciling the conflict of interests between the two countries in the U.S.A. sugar market.

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Cuban Political Troubles.

The Cuban Government, headed by the Prime Minister, Senor EMILIO NUNEZ PORTUONDO, who assumed office less than a week before, resigned on 12th March. This action followed the suspension of Constitutional Guarantees throughout the island for forty-five days, (the maximum permitted by the Constitution) in an effort to stem the spread of terrorism and to meet threats to call a general strike. A new cabinet headed by Sr. GONZALO GUELL, the former Minister of State, was later appointed. A censorship has also been imposed, which will only add to the uncertainties felt by those concerned with the sugar situation.

There has been a clash between Government troops and heavily armed rebels in the neighbourhood of Central Miranda in Oriente province. A dynamite attack was made on a rum distillery at Santiago de Cuba—third largest in the island—and very heavy damage was sustained.

According to Press reports from Havana, President BATISTA acted after the rebel leader FIDEL CASTRO had ordered "a fight to the finish."

Throughout these days of political unrest in Cuba the trade has been very reluctant to admit any possibility that the production of sugar will be interfered with[1], for it is the life-blood of the country and very much the concern of almost every individual in the island, and it has never been felt that rebel action of itself would be very effective towards such an end.

There is, of course, the possibility that political feelings might find expression in organized labour stoppages, as has happened before. Any prolonged stoppage would of course be a serious matter even if this did not involve the sugar producing section of the community for, quite apart from Cuba's importance in the United States domestic market, she is also the largest sugar supplier in the open market, and values in both centres would be highly sensitive to such a happening.

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South African Sugar Record.[2]

The South African sugar industry established a new record of production when at the end of January when, with 13 of the 18 factories closed, 947,286 tons of sugar had been manufactured from 8,481,175 tons of cane. This is over 8000 tons more than the record total of production, amounting to 938,980 tons, set in 1955/56.

The crushing season has been longer than usual this year, due largely to the increased quantity of cane harvested and it is estimated that final production will be more than 958,000 tons of sugar. Boiling house performance has improved, the crushing rate has been higher than in recent years, and the sucrose extraction has also been increased. The weather during January was excellent and points to another record crop in the 1958/59 season.

Last year (to the end of January 1958), South Africa exported 162,500 long tons, including 48,000 long tons sent to the Federation of Rhodesia and Nyasaland.

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Trinidad Sugar Estates Ltd., 1957 Report.

The crop for 1957 was again a disappointing one showing a reduction of 397 tons compared with 1956. This was due to the low yield of cane resulting from weather conditions and froghopper damage in 1956 and 1957. As a result of very dry weather during the growing season, cane yields this year are expected to be light and a crop of the same tonnage as in 1957 is expected. A dividend of 6% was approved.

[1] C. Czarnikow Ltd., *Sugar Review*, 1958, (345), 51.
[2] *Oversеas Review*, (Barclays D.C. & O.), March 1958, 14.

SUGAR CANE BREEDING IN COIMBATORE

ANNUAL REPORT, SUGAR CANE BREEDING INSTITUTE, 1954-1955.

THE Institute has undergone an expansion since its early foundation, through which it tends to exceed its title, in that some of the subjects studied therein are only indirectly linked with its primary function—cane breeding. The Director's Report (18 pp) gives a general survey of the Institute's activities and further detail is given in the Reports of the seven Sections.

A favourable season enabled 289 crosses to be made by the Cane Breeding Section. Of these, 32 were bulk crosses between proven varieties; 30 to meet the requirements of sub-tropical and two those of tropical conditions. Other objectives were the assessment of newer Co varieties as parental stock, the evolution of disease (red rot) resistant and of chewing varieties, and the introduction of imported blood. One inter-generic cross, Co 780 × *Sorghum Durra*, and a number of selfings of good commercial varieties were also made. After passing through the various selective trials, 50 varieties have been raised to Co rank, 25 each for tropical and sub-tropical conditions.

The Report of the Second Cane Breeding Officer refers to the annual repetition since 1951 of crosses which, in the past, have yielded valuable varieties, Co 419 (POJ 2878 × Co 290) and Co 421 (POJ 2878 × Co 285). So far, one seedling of each has reached Co rank. Much of the remaining work is linked to cytological studies. Intergeneric crosses between *S. officinarum* (Manjri Red, 2n=80) and both *Erianthus ciliares* (2n=40) and *Sclerostachya* have been made and notes are given of their morphology. There is also given a record of the chromosome numbers of successive back crosses to both the *S. officinarum* (2n=80) and the *S. spontaneum* (2n=64) parent. In the second generation of the former back cross, the *spontaneum* complement is reduced to n=8 and, in the latter, the *officinarum* complement in the fourth generation is reduced to n=10.

The Report of the Botanist records the completion of the *S. spontaneum* survey in India. This brings the collection of wild canes, including *S. robustum*, *S. edule*, *Erianthus spp.*, *Sclerostachya* and *Narenga*, to 516. Morphological, anatomical and taxonomic notes are given on these. Chemical studies include measurement of starch and levulose content, and observations on disease and pest resistance are also recorded. The commencement of the world cane variety collection, to duplicate that at Canal Point, Florida, is noted; this is in accord with the resolution passed at the 8th Congress, I.S.S.C.T.

The Chemistry Section was engaged in analysing the juice quality of the newer Co varieties. Particular attention has been given to the relationship between juice and jaggery quality and to the methods of storing jaggery. Notes are given of a survey of the factories in Bombay State, Madhya Bharat, Bhopal and Rajasthan.

The Physiology Section was mainly concerned with studying the factors controlling flowering. Pot studies indicated a definite check to flowering from exposure to extra light of 4 hours in continuation of day, but, generally, a stimulation of flowering from 2 to 4 hours' extra dark in continuation of night. In the field, extra light period produced the same effect, but the additional dark had the reverse, inhibitory, effect. Complex results were obtained when switches from extra light to extra dark were made, and when exposure was made at different ages and to varieties having different ages of maturation.

The Mycological Section records the reaction of new Co varieties, of *S. spontaneum* variants, and of allied genera and inter-generic hybrids, both to red rot and smut. Notes are given on rust, mosaic and *Helminthosporium* blight, together with certain other diseases; all these are classed as minor.

The incidence of the two borers, *Proceros indicus* and *Chilotraea infuscatellus*, together with experiments in insecticidal control of the latter, are reported from the Entomological Section. Notes are also given on termite control, on the effect of planting at different seasons on pest incidence, and on the effect of certain organic insecticides on germination. Heavy dressings, particularly of BHC, appear to have an adverse effect.

At the Karnal Sub-Station comparative varietal lists are given for characters such as pest and disease resistance, germination, vigour, tillering, flowering, ratooning and, of particular importance in northern India, frost resistance.

H.M.-L.

The Louisiana Sugar Cane Variety Census, 1957. L. P. HEBERT. *Sugar Bull.*, 1957, **35**, 376–379.—The varietal changes which have taken place since 1941 are described and expressed diagrammatically. The marked change is the spread of CP 44/101; first appearing as a commercial cane in 1949, it now occupies over 50% in each of the three areas of the Belt.

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Summary of Experimental Work on Sugar Cane. 1955-56. ANON. *Victorias Milling Co. Expt. Sta. Release*, 1957, (13), 22 pp.—The major problems discussed are the growing soil acidity with the associated poor growth (pH 4·5 critical), the search for a variety to replace H 37–1933, so susceptible to leaf scorch, the control of this major disease and of weeds and, finally, mechanical loading.

CANE AGRICULTURE IN SOUTH AFRICA

Development in the Scheduled Native Areas

IN 1954 the Commission for the Socio-Economic Development of the Bantu Areas within the Union of South Africa delivered a massive report, itself running to 3755 pages and the Summary to 211 pages. The report, known for brevity as the Tomlinson Report, outlines a scheme of development for the "Scheduled Areas" or "Reserves"—those areas prescribed under the Natives Land Act of 1913 for occupancy by Bantus—under which the Bantu population will be free to develop their own culture on lines parallel to the European population. Schemes are given for development in the very varying climatic conditions and, among these, are recommendations for cane cultivation in the Reserves associated with the sugar belt of Natal and Zululand. Here, it is estimated, lie 44,000 acres of suitable land with a possible 100,000 acres when the necessary roads and railways are provided. A five-year programme is suggested for the development of the initial 44,000 acres in 1000-acre blocks divided into holdings capable of yielding 80–90 tons of cane. It is stated that the scheme should be so designed as to permit the Bantu themselves taking over its administration and organization as soon as they are fit to do so. To this end tenancies will form the first step with option to purchase a holding as soon as outstanding advances are paid off.

An account of the progress made in the development of these blocks has recently appeared.[1] Of the four schemes, that at Groutville has the advantage that it is on virgin land, and the opportunity has been taken to group the families into residential areas. Estimated production this season has reached 44,000 tons which is fed to the Melville mill. The other three areas are not so advanced.

There are certain aspects of the scheme which are not fully explained and on which further information would be desirable. Thus, the account deals only with the individual holdings of 8–10 acres as they apply to cane growing. But a community requires an area set aside sufficient to produce its subsistence requirements; it would lead a precarious existence if dependent on a single crop subject to the price fluctuations of a world market.

A further point which will require clarifying as the schemes develop is the statement in the Report (Summary p. 123) that one of the conditions of allotment should be that future cane growers form a co-operative organization to deal with their common affairs. There is here no suggestion of maintenance of the tribal organization within the several schemes, yet the latest statement is that the Native Affairs Department is working with individual farmers with the aim of eventually handing over control to the tribal authority, a policy which applies to all Trust lands. This latter is a policy of co-partnership rather than co-operation. H.M.-L.

Species and Varieties of Sugar Cane. F. F. DE TOLEDO. *Solo, Piracicaba*, 1956, **48,** Nos. 2–3–4, 43–52.—An outline is given of the systematics of the genus *Saccharum*, the methods of producing new varieties by hybridization, and the cytology and genetics of the seedlings. In Brazil the most successful seedlings so far have been those combining the species *S. officinarum*, *S. spontaneum* and *S. barberi* in their parentage; the Brazilian CB canes of this type are now beginning to supersede the Co canes. (Plant Breeding Abstracts).

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New Varieties of Sugar Cane in Tucuman. ROBERTO FERNANDEZ DE ULLIVARRI. *Esta. Exp. Agric. Tucuman Circular*, 1957, (153), 5 pp.—Brief notes are given of the most recent varieties, including representatives of the VA (Villa Alberdi) and EP (Est. Exp. Palmira) series.

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The Influence of Fertilizers on Sugar Cane. ROBERTO FERNANDEZ DE ULLIVARRI. *Esta. Exp. Agric. Tucuman Circular*, 1957, (515), 7 pp.—A few hints are given on the use of nitrogenous manures.

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A Danger Creeps over the Land. ANON. *Producers' Rev.* (Australia), 1957, **47,** (6), 33–34. **Attack on Giant Sensitive Plant.** ANON. *Australian Sugar J.*, 1957, **49,** 399, 403.—Attention was first drawn to the giant sensitive plant *Mimosa invisa* in Australia in 1948. It has since become widely spread and a growing menace to all cultivation. Eradication is likely to take time, for, like many leguminous plants, it has a hard-coated seed which can lie dormant in the ground for long periods. It is not, however, merely a question of eradication. The seed is being imported as a concomitant of "Centro" seed (*Centrosema pubescens* and *C. plumerii*, two tropical American plants of value as fodder and cover against erosion).

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C.C.S. Deterioration in the Burdekin Area. G. A. CHRISTIE. *Cane Growers' Quarterly Bull.*, 1957, **21,** 58–61. **High C.C.S. or More Tons Sugar per Acre.** NORMAN J. KING. *Cane Growers' Quarterly Bull.*, 1957, **21,** 66.—The two papers are complementary and indicate the delicate balance between C.C.S. and cane yield with the seasonal influence on that balance of varietal adjustments.

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[1] *S. African Sugar J.*, 1957, **41,** 723–727.

CANE VARIETAL STUDIES IN ARGENTINA

IN the last eighteen months much detailed information has been supplied concerning the experimental investigations conducted during the last nine years on the relative value of the large number of varieties both raised locally (Tuc series) and introduced. It is to be found in the mimeographed Circulars[1] No. 79 (24 pp), 80 (186 pp), 81 (51 pp), 82 Vol. 1 (153 pp) and 82 Vol. 2 (432 pp), presented by WILLIAM E. CROSS. They all follow a uniform pattern. For the most part the results of a number of varietal trials, in some cases extending to the eighth ratoon, are set forth in tabular form, a brief preceding introductory account is given describing the scope and conditions of the trials, and the data are subsequently re-tabulated under the individual varieties of which the parentage and a general description is also given. Data recorded include Brix, sucrose, purity, factory recovery %, yield of cane per 100m line and per hectare, and yield of sugar per hectare. Further tables arrange the varieties in order of merit on the basis of (*a*) yield of cane per hectare, (*b*) yield of sugar per hectare, and (*c*) recovery %, using a standard cane, usually Tuc 2645, as datum.

The data given in Circular 79 refer to certain varieties of the B, CB, Co, F and FC series, introduced through Uruguay; the results are, in some cases, carried to the fourth ratoon crop. The two leading varieties are CB 38/5 and Co 285, but their value lies in yield of cane, and neither equals Tuc 2645 in yield of sugar per hectare.

Circular 80 records in the same manner the results obtained with hybrid seedlings raised at the San Pablo Experiment Station and designated by that name followed by a number. The parentage of the varieties of this series, being bred locally, is given in considerable detail. The economic position is summed up in a comparison between members of the S. Pablo series and the four standard varieties Tuc 2645, Tuc 2683, Tuc 1149 and Tuc 2680, on the basis of yield of sugar per hectare according to whether the increase results from (*a*) yield of cane and recovery in the factory, (*b*) yield of cane only, or (*c*) factory recovery only, comparisons being limited to produce in the same trial. The S. Pablo numbers which appear in the respective lists as superior to the standards are: (*a*) 46 and 79 superior to Tuc 2645, and 163 to Tuc 2683; (*b*) 163, 258 and 270 superior to Tuc 2645, 258 to Tuc 2683, and 49 to Tuc 1149; (*c*) 160 superior to Tuc 2645, 122, 160, 172, 212 and 231 to Tuc 2683, and 167 and 196 to Tuc 2680.

Circular 81 details the information relative to eighteen CP (Canal Point) varieties. Of these, only one, CP 34/120, has proved superior to Tuc 2645 on both counts—yield of cane and factory recovery—with a total increase of sugar per hectare of 8·9%. CP 29/116, the only other variety to give an increase of sugar per hectare (in this case 18·8%), owed this increase entirely to additional cane to the extent of 33·5%, factory recovery being only 89·0% of that with the standard.

Circular 82 summarizes the results of the last nine years' varietal tests and covers, in part, the results recorded in the three earlier Circulars. The major addition is the large number of varieties of the Tucumán series described. No condensed summary can be given; of the varieties used as standards for comparison, Tuc 2683 has generally proved the best on the basis of yield of sugar per hectare, and here it is only possible to list the varieties which have surpassed this standard. They are CB 38/4; S. Pablo 122, 160, 163, 172, 212, 231 and 258; Co 290; Tuc 3197 and 4268.

H.M.-L.

New Mechanical Loaders. ANON. *Australian Sugar J.*, 1957, **49**, 409.—Brief, illustrated descriptions are given of the Toft and Mac-Parry loaders.

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Four New "Q" Canes. ANON. *Australian Sugar J.*, 1957, **49**, 369.—Diagnostic descriptions, cultural characteristics and parentage are given of the four most recent canes to be elevated to "Q" rank. They are Q 66, Q 67, Q 68 and Q 70.

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A New Variety— Q 70. C. L. TOOHEY. *Cane Growers' Quarterly Bull.*, 1957, **21**, 52, 57.—Information additional to that given in the preceding includes data of two field trials. A high Brix of 19·82° (standard CP 29/116, 18·38°) has resulted in combined plant and first ratoon yields of 104·32 tons cane per acre and 14·91 tons sugar (standard 91·52 tons cane and 11·53 tons sugar).

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Sterilizing Cane Knives. D. R. L. STEINDL. *Cane Growers' Quarterly Bull.*, 1957, **21**, 46.—The trials refer specifically to ratoon stunting disease. It is shown that simple immersion is inadequate; swabbing or scrubbing is necessary. In the absence of the disinfectants tested, boiling or burning with methylated spirit is advocated.

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The Batchelor Trailer goes into Production. ANON. *S. African Sugar J.*, 1957, **41**, 633, 635.—A brief and illustrated description is given of the Benada cane loader invented by Mr. BRIAN BATCHELOR.

[1] Of the Advisory & Experimental Office of the Sugar Industry, Tucumán.

Drainage the Big Problem at Umhlatuzi. ANON. *S. African Sugar J.*, 1957, **41**, 719–721.—The estate differs from the majority of Natal estates in that it is composed of reclaimed land now protected by banks. Drainage here assumes a key importance. The cultural system, including the varietal position, is described. An unusual risk appears to be damage both to banks and crop by hippopotami.

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New Techniques bring Higher Returns at Tongaat. ANON. *S. African Sugar J.*, 1957, **41**, 801–805.—An estimated yield of 40 tons per acre follows a yield of 32·8 tons in 1953. The reasons are given and lie in no one cultural process. Perhaps the most marked shift is from traditional plough to trash mulch and chisel. Radical changes in harvesting and transport, including the use of radio telephones, are also noted.

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Why Plough Out ? ANON. *S. African Sugar J.*, 1957, **41**, 895–899.—The practices adopted by J. L. WOOLLAM on the Hazara estate at 1500 ft altitude are described. The basis of these is trash left undisturbed with balanced fertilizer on top of the trash. By these means the sucrose per acre has risen from 5·33 tons in 1953 to a conservatively estimated 8·45 tons. The suggestion is made that cane, being a grass, should be treated like a meadow grass, provided with the basic nutrient requirements and only be ploughed out to substitute a better variety.

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Certain New Pests of Sugar Cane in Venezuela. F. GUAGLIUMI. *Acta Cientifica Venezolana*, 1956, **7**, (3).—A few additions to the former list drawn up by H. E. BOX and the author are noted.

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Variety Talk. L. L. LAUDEN. *Sugar Bull.*, 1957, **36**, 4.—Two new varieties approaching the release stage, CP 51–24 and CP 53–18, are briefly described. They both have the tendency to lodge, characteristic of N:Co 310. CP 52–68, a vigorous erect cane, is being multiplied up to the available seed cane in expectation of next season's release.

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Mud and Trash. L. L. LAUDEN. *Sugar Bull.*, 1957, **36**, 64.—A late growing season has given added difficulty in burning. This, plus the added grass, tops and mud gathered by the mechanical loader, has resulted in a harvest containing over 11% impurity—trash and mud. A modification of the conventional harvester to load directly into the wagon is suggested.

Sugar Cane Variety Tests in the Victorias Milling District. ANON. *Victorias Milling Co., Exp. Sta. Release*, 1957, (16), 1–14.—A richly tabulated account is given of the wide range of varietal trials conducted during the last two seasons in an effort to find a replacement for H 37–1933, now occupying some 43% of the cane area, but becoming increasingly subject to attack by leaf scorch.

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Manurial Responses in Cultivators' Fields. III. K. L. KHANNA *et al. Indian J. Sugarcane Res. Dev.*, 1957, **1**, 189–196.—The results are given of top dressings at earthing-up of sulphate of ammonia, ammonium chloride and urea, at 20, 40 and 80 lb N per acre. The respective increases per acre were: for sulphate, 3·4, 6·5 and 10·7 tons; for chloride, 2·8, 5·4 and 8·3 tons; and, for urea, 3·4, 6·8 and 10·4 tons. At the 20 lb level, net profit per acre is: for sulphate Rs 84, for chloride Rs 71, and for urea Rs 81. These are averages; the relative responses differed for varying soils.

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Laboratory Trials on the Chemical Control of Sugar Cane Leaf Hopper (*Pyrilla perpusilla* Walker). S. N. PRASAD and D. K. BUTANI. *Ind. J. Sugarcane Res. Dev.*, 1957, **1**, 197–201.—Of the insecticides tested as dusts and sprays, with effectiveness measured as extent and speed of kill, 5% "Toxaphene" dust led with 5% BHC or DDT dust following.

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Experimental Studies of the Factors controlling Flowering. II. M. VIJAYASARADHY and P. VANITHAMONY. *Ind. J. Sugarcane Res. Dev.*, 1957, **1**, 210–219.—Monthly plantings were submitted to 4 hours' darkness in continuation of the night from 6 and 18 weeks to flowering. In both cases, February-May plantings (at Coimbatore) flowered after a shorter vegetative period than June and later plantings. Other rather complex reactions, varying according to planting season, are also recorded.

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Outstanding Canes of Bihar. II. K. L. KHANNA *et al. Ind. J. Sugarcane Res. Dev.*, 1957, **1**, 202–209.—Morphological and agricultural characters of BO 10 are recorded. BO 10, a cross Co 331 × POJ 2878, is valuable mainly for resistance to red rot, but yields well and has a good juice.

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Studies on the Factors affecting Soil Fertility in the Sugar Belt of Bihar. VIII. K. L. KHANNA *et al. Ind. J. Sugarcane Res. Dev.*, 1957, **1**, 220–223.—Observations are given of the extent of phosphate fixation in the various soils of the Bihar Sugar Belt.

ASH-CONDUCTIVITY RELATIONS OF CANE JUICES

By J. C. VAN AREM (Factory Superintendent, Pradjekan Sugar Factory, Java, DKA/ET—R.I.)

It is a common experience in sugar factories in grinding the same cane variety that occasionally juices show abnormal effects in the liming and the settling of the precipitated non-sugars or an abnormal increase in the lime content of the clarified juice. All the evidence presented in the sugar literature indicates that these difficulties are partly caused by variations in the P_2O_5 content of the juices, by abnormal acidity, or by high content of organic acids in the raw juice.

It was our assumption that it would be possible by determining the conductivities at different Brix dilutions to get an indication of the amount of organic acids in cane juices, that is, the ratio of strong inorganic anions to weak organic anions. On the one hand, the acidity of cane juice, determined by titration with 1/28 N lime water to a pH of approx. 8·2 (using phenolphthalein as indicator) and the phosphate content of the juice would give us an indication of the organic acids present. As far as the evidence exists on the nature of the organic acids, it seems that most are rather weak acids, being only partly dissociated in dilute solutions.[1]

On the other hand, it is known that the conductivity of raw juices, measured under standardized conditions of Brix and temperature gives, according to HONIG, the concentration of the alkali and alkaline earth cations (K, Na, Ca and Mg) and of the strong anions Cl', SO_4'' and PO_4''' with some organic anions, but not the sesquioxides and silicic acid which represent an appreciable portion of the ash in raw juice. For this reason it was proposed to differentiate "sulphated" ash and "conductivity" ash as two fundamentally different quality figures.[2]

The Java Experiment Station, in standardizing uniform methods for the chemical control in sugar factories, never made a ruling for the determination of the total "ash" content in raw juice by means of the conductivity. The reason for this omission, given by HONIG, who was for many years in charge of the chemical and technological work of the Java Experiment Station, was that the relation between conductivity and sulphated ash was not proportional as found for sugar and molasses. Deviations are caused by the undissociated inorganic impurities in raw juices, which are largely precipitated in the clarification. It was our assumption, however, that it would be possible to determine the nature of the anions in cane juices by measurement of the conductivities at 10°Bx, 1°Bx and 0·5°Bx dilutions, corresponding to ash concentrations of approx. 0·1N, 0·01N and 0·005N. It is a well-known fact that the specific conductance of an electrolyte increases with dilution and that this increase is larger for salts of weak organic acids than for salts of alkalis and strong acids. In this way we expected that it would be possible to determine, as a rapid analytical method, the character of the anions in raw cane juices.

EXPERIMENTAL

The cane variety used in this study was almost exclusively POJ 3016. Before the beginning of the grinding season, juices of cane samples as used to determine the ripening of the cane were collected at Pradjekan sugar factory, Eastern Java. During the grinding season, primary juice samples from cane, of which the field locations were exactly known, were used. The samples were strained before analysis through a 54-mesh bronze sieve.

System of Analysis.—Brix was determined with a Java Experiment Station model hydrometer. Polarization was measured in a 200-ml tube after clarification with a solution of basic lead subacetate in a 100–110-ml flask.

CaO and MgO were determined by titration with soap solution[3], the results being expressed as CaO equivalents. Phosphate was determined colorimetrically with molybdate[4]. The acidity of the juice was determined by titration with 1/28N lime water, using phenolphthalein as indicator[5], and the results expressed as mg CaO per litre. Carbonate ash was determined by incinerating 50 ml of juice at 450°C, after drying with oxalic acid[6].

The conductivities were measured at 30°C after diluting the juices to 10°, 1° and 0·5° Brix. For the dilution, double-distilled water, free of CO_2, was used. The conductivity was measured with a Philoscope GM 4260 instrument.

A total of 43 juice samples were analysed from cane varying in age from 9·5 to 16 months and taken from different soil types. Tables I(a), I(b), I(c) are given as an example of the collected data.

The organic acids in Table I(b) were calculated under the assumption that the inorganic phosphate in cane juices is precipitated practically quantitatively in the clarification and that in the titration of cane juices with lime water the phosphate in juice uses approx. 1 CaO equivalent per 0·5 P_2O_5 equivalent.

This assumption is based on a large number of potentiometric titrations of cane juices, done at the Java Experiment Station between 1928 and 1940 and presented in the technical literature by HONIG[7]. The rest of the acidity must be ascribed as originating from organic acids.

[1] HONIG: "Principles of Sugar Technology" (Elsevier, Amsterdam). 1953, p. 135.
[2] HONIG: "Le dosage des cendres par la méthode conductométrique". Reports ICUMSA Meeting, Amsterdam, 1932.
[3] "Java Handbook" 1931 Ed. Vol. 1, Part 1, p. 321.
[4] SPENCER & MEADE: "Cane Sugar Handbook" 8th Ed. (Wiley, New York). 1945, p. 521.
[5] *Ibid*, p. 520.
[6] DE GROBERT: *J. Chem. Soc.*, 1890, **58**, 690.
[7] HONIG: "Principles of Sugar Technology" (Elsevier, Amsterdam). 1953, pp. 286–310.

It is generally accepted that the organic acidity, being the difference between total and phosphate acidity, is neutralized in the liming process and is the main cause of increase of the CaO content from mixed to clarified juice[8]. In the experiments this residual acidity was found to vary from 0 to 300 mg CaO equivalent per litre. When the phosphate content is high, the residual acidity is low, and vice versa.

As to variation of the ash content of the juices, the following data were recorded as the overall results in experiments for the cane milled in 1955 at Pradjekan:—

	Ash content g carb. ash per 100°Bx	Conductivity in reciprocal ohms × 10^3 at dilution 10°Bx	1°Bx	0·5°Bx
Average (n=43)	2·31	2·53	0·339	0·182
Highest	3·51	4·06	0·557	0·307
Lowest	1·56	1·48	0·207	0·115

The relationship of the ash content with the conductivity is summarized in Fig. 1. It can be expressed in the formula: Ash % Brix = 0·06 + 0·85μ, where μ is the conductivity at 30°C of a 10°Bx solution.

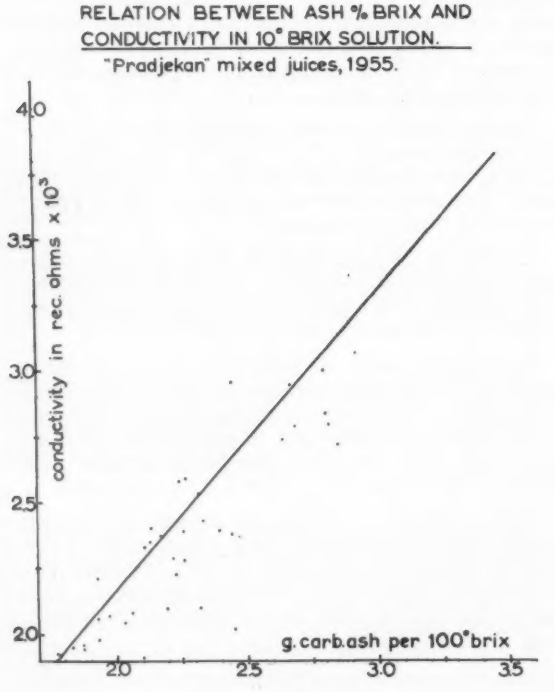

Fig. 1.

The deviations found in individual samples are rather great, the highest found being approx. 20%; but this difference between the calculated carbonate ash and the value found by experiment is of the same magnitude as differences found between carbonate and sulphated ash. For twelve samples of juice of which the sulphated ash was also determined, the difference between carbonate and sulphated ash varied from 2·9 to 22·4%.

The variation in the carbonate ash content around the average was found to be —42% to +60%.

For the determination of the "soluble" ash, it is our impression that the conductivity method can be used instead of the direct ash determination by incineration of a known weight of juice.

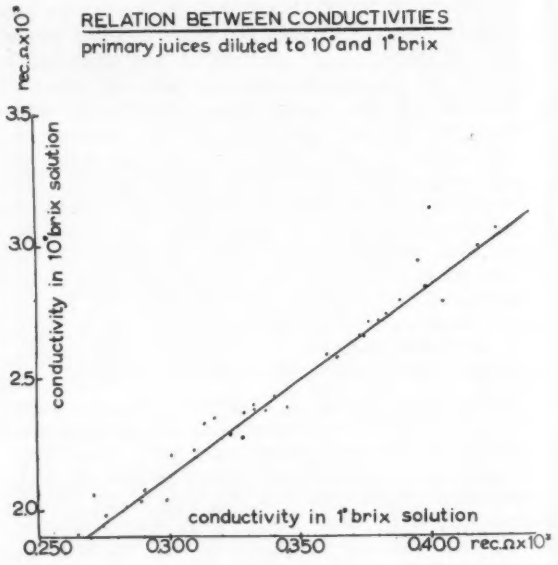

Fig. 2.

It gives in any case an indication of the origin of juices with low and high ash contents. In modern sugar mills it is practically impossible to determine the ash content in juices originating from different fields via the direct ash determination. The conductivity method is rapid, and once the equipment has been set up the whole procedure, including the dilution, bringing to temperature and measuring conductivity, makes it possible for an experienced bench chemist to analyse at least ten juice samples per hour.

Trying to determine the ratio of inorganic and organic anions by dilution of the juice from 10° to 1°Bx, and to calculate the relative conductance in relation to the more dilute solution in which the more complete dissociation of the inorganic constituents would occur gave a negative result.

In Fig. 2 the relationship between the conductivity of a 10°Bx and a 1°Bx dilution is summarized. The deviation from the average is practically within the experimental errors. It was not possible to find any relationship between the organic acid content, acidity and the dilution effect on the specific conductance.

[8] *Ibid.* p. 344.

Table I(a)

No. of sample.	Name of field.	Block	Date of harvest	Age of cane at harvest (months)	Brix	Purity
1	Blimbing	B1	6/5/55	11	14·2	80·3
2	Taal	A2	7/5/55	11½	16·6	85·2
3	Tjindogo W.	A1	11/5/55	13	17·7	88·3
4	Kapuran	B1	13/5/55	9½	16·2	84·8
5	Kerang	A1	14/5/55	13½	18·5	87·8
8	Kadjar	A1	25/5/55	10	17·8	87·9
14	N. Mrawan	A1	13/6/55	11½	17·5	87·8
15	Kontjer	A1	25/6/55	12	18·9	90·3
29	Wonokerto	B1	10/8/55	15	18·3	90·0
39	Taal	A1	25/9/55	16	21·7	90·6
41	Kapuran N.	A3	25/9/55	13½	20·3	90·1

Table I(b). Analysis.

No. of sample.	CaO+ MgO mg/litre	g carb. ash per 100°Bx	Inorg. P_2O_5 mg/litre	Acidity mg CaO/litre	Calcul. org. acids in mg CaO eq./litre
1	171	2·82	224	406	229
2	272	2·22	376	399	102
3	268	2·24	298	468	233
4	171	2·33	270	466	253
5	288	2·39	560	528	86
8	254	1·92	344	356	84
14	171	2·26	240	408	218
15	188	2·13	70	320	275
29	305	2·31	510	552	149
39	305	1·99	680	614	84
41	297	2·12	700	533	0

Table I(c)

No. of sample.	Conductivities in rec. ohms $\times 10^6$ in dilution: 10°Bx	1°Bx	0·5°Bx	Specific conductance in dilution: 10°Bx	1°Bx	0·5°Bx	Relative conductance 10°Bx	1°Bx
1	2801	390	207	993	1383	1468	67·9	94·2
2	2231	310	171	1005	1396	1540	65·3	90·6
3	2576	365	193	1150	1629	1712	67·2	95·2
4	2429	341	180	1042	1464	1546	67·4	94·7
5	2395	346	182	1002	1448	1524	65·7	95·0
8	2209	301	159	1151	1568	1656	69·5	94·7
14	2589	361	192	1146	1597	1700	67·4	93·9
15	2352	318	169	1104	1493	1586	69·6	94·1
29	2657	375	195	1150	1623	1688	68·1	96·1
39	3004	419	223	1509	2105	2240	67·3	94·0
41	2326	314	172	1097	1481	1622	67·6	91·3

Specific conductance: $\frac{\text{cond. in rec. ohms} \times 10^6}{\text{ash content solution in g/litre}}$

Relative conductances are to specific conductance of 0·5°Bx sample = 100.

Conclusions

For a rapid estimation of the amount of ash in primary juices, the conductivity method can be used if we bear in mind that deviations from the true carbonate ash content of ±18% are possible. For most juices, once this relationship has been determined for a specific mill, the differences for at least 80% of the juices are not larger than ±8% of the calculated value.

The determination of organic anions indirectly, by using the specific conductance at different dilutions as an indication of the ratio organic/inorganic anions present in cane juice, cannot be recommended, because the differences between juices varying in phosphate content and organic acid content do not show a special effect in the specific conductance at different dilutions.

Acknowledgment

The writer wishes to thank Dr. P. Honig, of New York, for his helpful suggestions and criticism of the original draft.

Irish Sugar Production, 1957/58.[1]—Beet processed totalled 808,039 metric tons (636,410 in 1956/57) and yielded 120,046 metric tons of sugar, raw value (98,497 tons in the previous campaign).

* * *

Sugar Cane Experiments in the Dominican Republic.—The Dominican Republic Sugar Development Committee's experimental stations are conducting genetic investigations to obtain new varieties of sugar cane most appropriate to the soil and climate of the various sugar-growing areas of the country and to halt degenerative tendencies. Other experiments will be carried out on pineapples, alfalfa and other plants. Success has been obtained with interspersed sowing of beans and sugar cane. Dual cultivation, started last year, besides encouraging increase in cane, has considerably increased local production of beans, which is one of the staple foods of the Republic. The sugar crop this year, according to a government forecast, will exceed a million tons, a considerable increase on that of the last two years.

Taiwan–Japan Trade Agreement.[2]—Under the terms of an agreement signed on 31st August 1957, Japan is to import goods including U.S.$40m worth of sugar, the price per ton being based on the spot price of the New York No. 4 contract.

* * *

Finland 1957 Campaign Results.[3]—A total of 274,489 tons of beet, including 37,724 tons imported from Denmark, were sliced, total sugar production being 28,756 metric tons, white sugar value, compared with 28,991 tons the previous year.

* * *

Argentina Production, 1957.[4]—The 1957 campaign came to an end on 2nd November last with an outturn practically 70,000 tons below the previous year's figure. Production was 660,519 metric tons, compared with 728,466 tons in 1956, the principal drop being in Tucumán (62,669 tons lower).

[1] F. O. Licht, *Int. Sugar Report*, 1958, **90**, (Supp. 3), 7.
[2] *Taiwan Sugar*, 1957, **4**, (9), 13.
[3] C. Czarnikow Ltd., *Sugar Review*, 1958, (338), 20.
[4] C. Czarnikow Ltd., *Sugar Review*, 1958, (341), 32.

BULK RAW SUGAR LANDING AND STORAGE AT LIVERPOOL

The Huskisson Dock Project, 1957

THE first cargo of raw sugar in bulk arrived in England in April 1949 in the *Baron Haig* which carried 5000 tons of sugar from San Domingo; this was received by the Thames Refinery of Tate & Lyle Ltd. The table shows how the proportion of raw sugar received in bulk at the Tate & Lyle refineries has increased, and that of sugar received in bags decreased.

Table I

Annual Arrivals of Raw Sugar for Tate & Lyle Ltd.

	Bulk	Bag
*1949	5,073	1,477,768
1950	51,656	1,418,751
1951	269,507	1,437,225
1952	660,531	837,327
1953	738,291	834,533
1954	1,228,336	671,567
1955	1,138,368	1,003,765
1956	1,409,906	534,050
1957	1,647,515	532,141

* Up to 30th September each year.

Forty years ago, raw sugar was exported from Java in large baskets; but the time, trouble and expense involved in handling these clumsy packages caused their disappearance, which was not regretted by any sugar refiner. Bags, which are now regarded as an expensive and avoidable nuisance, are bound to follow the Java baskets into oblivion.

The first bulk sugar ship to arrive in Liverpool was the *Sugar Transporter* in August 1952, carrying 3700 tons of raw sugar from one of Tate & Lyle's estates in Jamaica. The sugar was discharged from the ship by four cranes with a total unloading capacity of 340 tons/hour. It was not long before the advantages gained by unloading bulk sugar ships at a rate much faster than can be achieved with ships carrying sugar in bags, and the convenience and speed of filling and emptying the vehicles which transport the sugar from the dock to the refinery, demanded the provision of another berth equipped with cranes for unloading the sugar in bulk.

During 1953 a scheme was prepared which included a warehouse to hold 100,000 tons of sugar in bulk, as well as four new cranes able to discharge up to 600 tons of raw sugar per hour from a ship. By the beginning of 1954 the plans and estimates were ready, and at the end of 1954 it was decided to proceed with the work. The 100,000 tons of raw sugar in the store is sufficient to supply the Liverpool refinery for about six weeks, or the two London refineries and the Liverpool refinery for about two weeks. The project was officially opened on 5th December 1957, by which time the store contained 29,000 long tons of raw sugar.

The complete installation comprises two raw sugar landing berths, a weigher tower, a vehicle filling tower, the storage silo, and the comprehensive interconnecting conveyor system.

A separate building houses the management and office staff as well as H.M. Customs Officers. Canteen and welfare facilities are provided for all employed in the office and in operating the handling equipment in connexion with the weighing, storage and delivery of raw sugar.

The silo, and the weigher and vehicle filling towers, are separated from the berths by the Dock Road. Landed raw sugar crosses the road and the old overhead railway on band conveyors installed in an inclined gantry rising 100 feet to where it enters the weigher tower. During peak unloading, sugar will be crossing the Dock Road at the rate of 16 tons per minute.

The total weight of concrete mixed for the project was 24,000 tons; 1700 tons of structural steel and over half a million bricks have been used. There are 84 electric motors installed, having a combined output of 1900 h.p. The canvas used in the making of the various conveyor belts would cover an area of little under 5 acres. From these facts it will be gathered that the installation comprises a large amount of machinery and was in every way a major undertaking.

Raw Sugar Landing Berths

The east and middle berths can both accommodate vessels carrying a burthen of up to 10,000 tons of bulk raw sugar. Both are equipped with four cranes carrying grabs. The eight cranes discharge on to two lines of belt conveyors, running the full length of the quay.

The four cranes on the middle berth are 5-ton single rope cargo cranes, fitted with automatic grabs. Each crane has a mobile hopper located behind it and running on rails. The crane grab discharges its sugar into the hopper and a band conveyor fixed below the hopper transfers the sugar on to the quay conveyor.

The four cranes on the middle berth were originally installed on the east berth and landed their sugar into 25-ton hoppers. Road vehicles ran below the hoppers for loading, and then removed the sugar to the refinery. This scheme started the landing of bulk raw sugar in Liverpool in 1952, and has satisfactorily bridged the gap between the commencement of this new method of handling and the execution of the comprehensive project completed in December 1957.

The cranes now installed on the east berth are new multi-rope 5-ton grabbing cranes of the "kangaroo" type. These cranes have a hopper built into the front of the crane itself, which enables the crane driver to lift a grab of sugar and drop it in the opening immediately beneath him, in much the same manner as a kangaroo has access to its pouch. This produces a simpler and faster operation, as it reduces the need for slewing.

The combined unloading capacity of the new cranes on the east berth is some 600 tons per hour, whilst those on the middle berth can achieve 340 tons per hour.

Each cargo must be kept separate until samples have been drawn, and both the landed weight of the cargo and the weight of sugar delivered direct to the refinery have been determined. To achieve this, the sugar from each ship is carried on separate quayside conveyors to the end of the east berth. At this point it is transferred to the conveyors which run up the inclined gantry, across the Dock Road, and up to the top of the weigher tower.

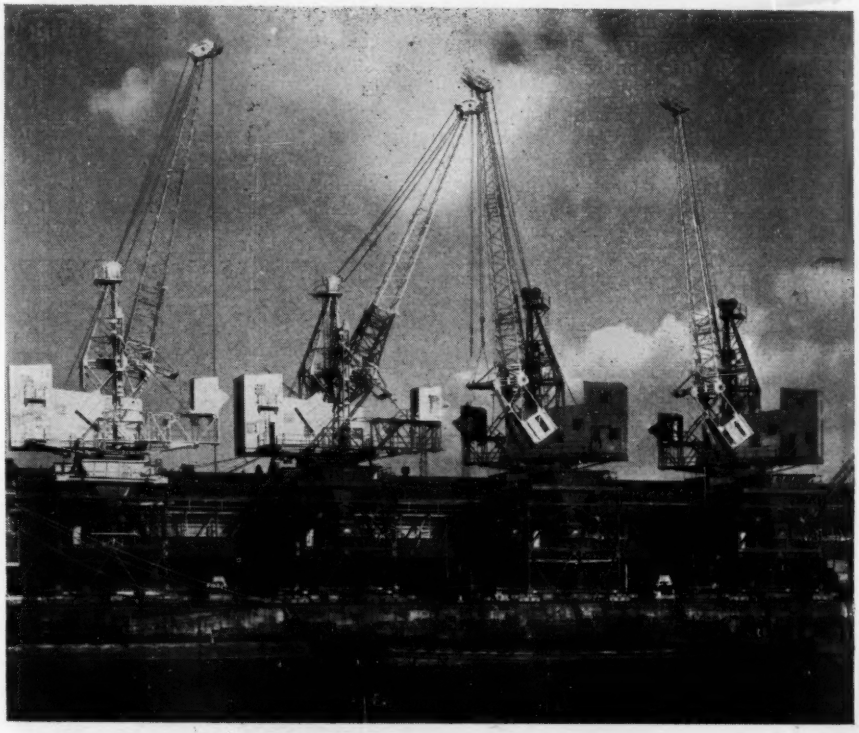

Fig. 1. The four "Kangaroo" cranes.

Weigher Tower

The weigher tower is of brick construction with a steel frame; it is 120 feet in height and rests on piled foundations. At the top of the weigher tower the raw sugar falls into the weighing machine hoppers, each cargo being kept separate. At this point, samples are drawn by the Sugar Association of Lancashire for analysis.

From the hoppers the raw sugar is weighed in three Servo Balans weighing machines, each capable of weighing 400 tons of raw sugar per hour in 15,000 lb lots. Arrangements are such that one or two weighers can be allocated to either berth, depending on the rate of discharge of the vessel at that berth. Provision is made for the installation of a fourth machine.

The purchase price of raw sugar, and the duty payable, are related to the quality as determined by analysis, and the landed weight. Correct sampling and weighing are therefore of the utmost importance to the refiner, the seller, and H.M. Customs, and this most vital aspect of raw sugar landing is adequately taken care of by the facilities provided. The landed weights, as determined by the Master Porter, are also used to ascertain the dues payable to the Mersey Docks & Harbour Board on the cargo.

The controls and dials of the weighing machines are situated in a room isolated from the general space.

Immediately above the weigh office, and with a direct intercommunicating stairway, is the main control panel for the whole conveyor system. From this point most of the installation can be viewed through easily accessible windows, and a small manual telephone exchange communicates with the eight crane drivers and with other key points of the system.

After weighing, the raw sugar is conveyed through a gantry, which rises to the top of the vehicle filling tower, each cargo still being separate.

Vehicle Filling Tower

The vehicle filling tower is a steel-framed structure straddling two road weighbridges and a weighing office. The upper part of the tower forms the transfer station between conveyors leading from the bottom of the weigher tower, and those leading to the shuttle conveyors in the top of the silo. Contained within the tower are two 130-ton hoppers, each of which is located above a road weighbridge. The landed

raw sugar may be discharged in total or in part into one or other of these hoppers for loading into road vehicles or, again, in total or in part, it can pass to two further conveyors leading to the top of the bulk storage silo.

The conveyors leading to the silo run in a gantry, which also provides access to inspection platforms situated high up on the gable end within the silo, and from which the pile may be viewed for control purposes.

Raw sugar intended for direct delivery to the refinery is gravity fed from the appropriate vehicle filling hopper into the waiting vehicle as it stands on the road weighbridge. The weight of raw sugar removed from this point is thus easily ascertained, and, as the landed weight of that particular cargo has been determined in the weigher tower, the quantity of sugar put into the silo is known by difference.

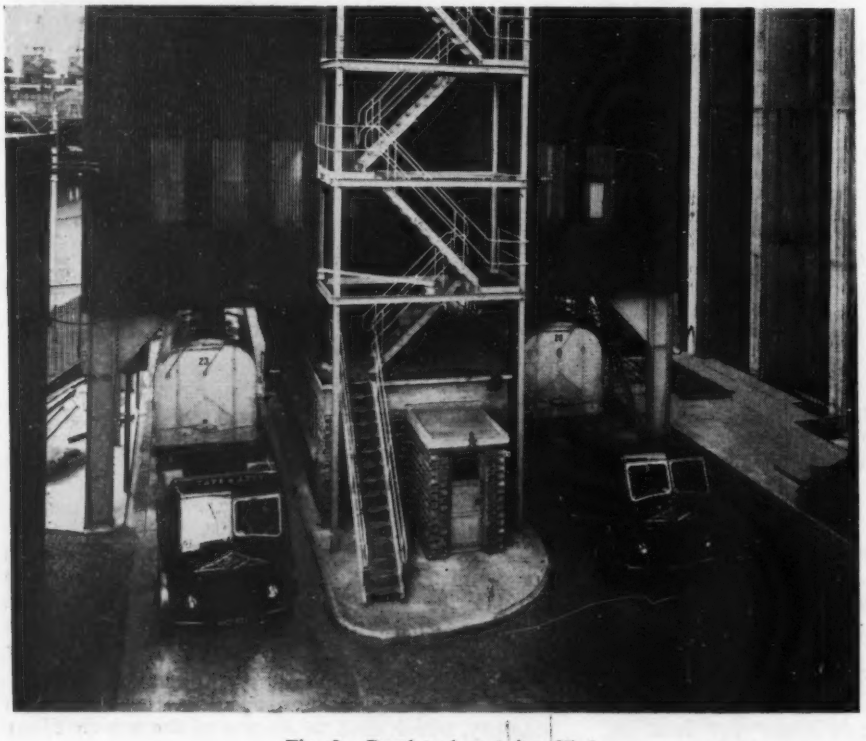

Fig. 2. Road tankers being filled.

The weighing office houses the two weighbridge dials, from which the weights are called out for entry on to the various documents relating to the removal of raw sugar.

In designing the arrangements for the filling of vehicles from the hoppers, it was necessary to provide for the following types:—

(1) Tractor/trailer units carrying two specially designed boxes as used at present.

(2) Rigid 8-wheel vehicles carrying two specially designed boxes mounted on the chassis.

(3) Vehicles as yet to be developed, but designed to give a better pay load per unit cost both in initial capital outlay and running expenses.

The Storage Silo

The storage silo is among the largest of its type yet built. Its construction is parabolic in shape, the width being 166 ft at the base with a height to the apex of 86 ft. It is 543 ft in length. The shell is of concrete and was cast in twelve sections.

The silo, with its floor slab, stands on 460 concrete piles. The whole structure is reinforced with steel, and during construction of the twelve arch sections, the floor, and the two gable ends, 700 tons of steel bar and 105 miles of high-tensile steel wire were fixed, and then encased by 18,000 tons of concrete.

The silo will hold about 100,000 tons of raw sugar in bulk. There is a housing on the top for two lines of band conveyors which receive the sugar to be stored, and these, in turn, feed two reversible shuttle conveyors. This arrangement enables sugar to be dropped into the silo at any point throughout its length and thus form the pile. The pile grows in width at its base until restrained by the lower walls of the silo itself. At this point the walls of the silo have been designed to withstand the thrust imposed by the sugar pile. Following this, the sugar takes up its natural angle of repose, resulting in the face of the pile remaining clear of the walls of the soli over the upper part of its contour.

Raw sugar is reclaimed from the bottom of the silo by a band conveyor located in a tunnel beneath the floor. An open trench in the floor of the silo, running along the centre line above the tunnel, allows sugar to fall into louvred hoppers, and the fall-out from these hoppers can be regulated by the louvres to give the desired feed on to the band conveyor at each point. About half the sugar stored will fall by

gravity into these hoppers and thence on to the conveyor. The remainder will be moved to the central trench by mobile equipment.

From the silo tunnel, the raw sugar is conveyed by an inclined band which rejoins the main conveyors just below the Servo Balans weighers. The reclaimed raw sugar is put on to one of the conveyor bands and carried into one of the hoppers in the vehicle filling tower. From here it is loaded, weighed, and despatched to the refinery.

Conveyor System.

The conveyor system provides a separate path from each berth right through to the top of the silo. The necessity for maintaining the discharge of vessels with some degree of plant breakdown has been envisaged, and catered for where possible.

Fig. 3. The interior of the silo.

There is only a single conveyor system for reclaiming from the silo, as in the event of a breakdown on this system, raw sugar for the refinery would be found from other sources pending the completion of repairs.

All conveyors consist of rubber and canvas belts driven at one end. The speed of the conveyor drum at the far end from the drive is compared by electrical means with the speed of the driven end, so that any slip between the driving pulley and the belt is shown up at once on the control panel. A slip of this nature causes accelerated wear of the conveyor belt.

The total length of belting used in the conveyor systems is 1¾ miles, and in order to get as much life as possible from this expensive installation, all conveyors are fitted with variable-speed drives so that they need not be run faster than required to handle the sugar at the rate at which the cranes are discharging the ship.

The controls for setting up the conveyor speeds are all carried back to a central panel in the weigher tower, sited just above the Servo Balans machines, and an elaborate intercommunication system is also provided.

Throughout the installation every precaution has been taken to prevent spillage. Raw sugar is expensive, so it is essential in the interests of all parties that all is weighed and nothing wasted.

A passenger lift runs the full height of the weigher tower. From here the various routes can be followed, with little necessity for climbing.

Swedish Sugar Consumption Drop[1].—The Swedish Sugar Company, in its annual report, says that domestic sugar consumption in the 1957/58 financial year is expected to decline to around 314,000 tons from 331,000 tons last year. Sugar production is expected to cover 92% of domestic needs against 83% in the 1956/57 financial year.

* * *

Cuba—Austria Trade Agreement[2].—The Trade Agreement between Cuba and Austria has been extended until 31st December 1959. Thereafter it will be automatically extended unless either party gives notice of its intention to negotiate a revision within three months of the date of expiry. For as long as the treaty remains operative, the Austrian Government agrees to purchase 10,000 tons of Cuban raws annually.

* * *

Bulk Handling at Greenock[3].—The discharge of bagged sugar at the port of Greenock ended recently when a £250,000 bulk handling plant was brought into operation. This comprises three 5-ton high-speed electric cranes, each lifting 2½ tons in a grab and depositing it in an adjacent 25-ton hopper, at a maximum rate of 200 tons per hour for each crane. Sugar is transported to the refineries or dock sheds in a fleet of 16 eight-ton diesel tipper trucks.

[1] *Public Ledger*, 15th March, 1958.
[2] C. Czarnikow Ltd., *Sugar Review*, 1958, (340), 28.
[3] *Times Rev. of Industry*, March 1958, 68.

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THE DETERMINATION OF SUGAR IN SUGAR BEETS

By Wm. H. PARKER, M.Sc. (Chief Chemist, British Sugar Corp. Ltd.)

PART I.

THE correct assessment of the extractable sucrose or "sugar" in samples of sugar beets is of the greatest importance to the beet sugar industry, not only because this raw material is generally purchased on the basis of the sugar content, but also for factory control purposes.

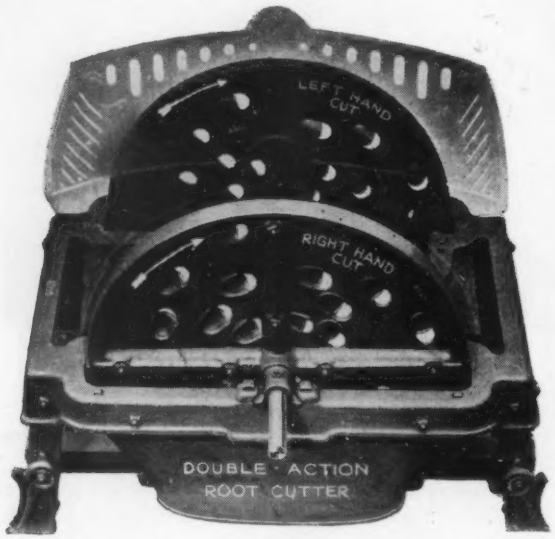

Fig. 1.

It is assumed that a satisfactory sampling technique is employed to produce a sample or samples which, by and large, are representative of the bulk. Owing to the extreme variations in the sugar content of individual roots, wide variations can, and in fact do, occur between different samples in individual consignments. However, having secured a sample (from beet deliveries to the factories this is normally about 25 lb in weight), two problems arise:—

(*i*) to prepare a reduced sample of manageable proportion which is fully representative of the bulk and in such a state of division that it responds adequately to the analytical procedure applied to it;

(*ii*) to establish an analytical procedure which correctly assesses the percentage by weight of extractable sugar in the sample so obtained.

Sugar beet contains essentially two distinct states of matter, one solid (the cellular material or "marc") and one liquid (the juice containing the sugar in solution amongst a multitude of other ingredients). To maintain these two states of matter in their correct proportions in a prepared sample and to make this homogeneous by mechanical means is not an easy task, especially where large samples or roots in an abnormal condition are concerned. If this is not achieved, the analytical results will be valueless.

In this series of articles it is proposed to describe the development work that has been carried out over the past seven years by our Chemical Control Service department.

PREPARATION OF SAMPLES FOR ANALYSIS

(PART I)

(A) *From samples of whole roots.*

Two methods are used. The first involves grinding up the whole of the sample and reducing its bulk by

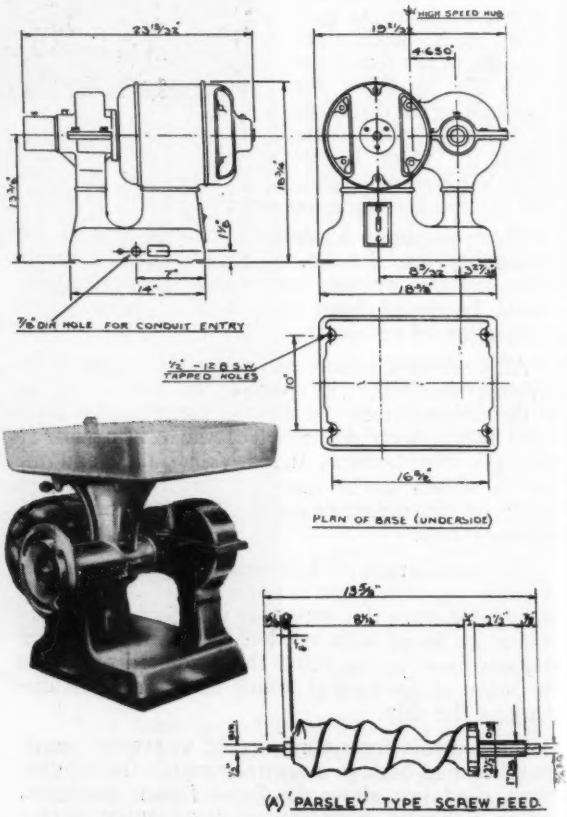

Fig. 2.

stages. This is a very lengthy process but if properly carried out does ensure that all the sample is represented. In the second method the whole of the

sample is fed into a machine in which saw blades cut sections out of each root completely at random, producing a pulp which is representative of the whole and ready for analysis by any of the methods usually employed.

Method I—Grinding up the whole sample.—The roots are first passed through a "root cutter" (shown in Fig. 1), which is either hand-operated or power-driven. This cuts them into small pieces approximately $\frac{7}{16} \times \frac{1}{4}$ inch, the whole then being reduced by mixing, quartering and riffling to reduce the bulk from about 25 lb to something like 5 lb. The reduced sample is then passed through a Hobart Model E.232 meat chopper or mincing machine (shown in Fig. 2), fitted with plates having $\frac{3}{16}$ inch holes and a Parsley type screw feed (seen in Fig. 2*a*). It is important that only this type of screw feed is used if expression of juice is to be avoided.

Method II—The "Multiple Saw" Machine.—In this method the whole of the sample is fed into a hopper attached to the machine and at the base of which is a revolving "carriage". This consists of a slotted cylinder containing four hollowed-out quadrants into which a proportion of the roots drops in turn, and they are thence carried through seven circular saws arranged on a common shaft at equal distances of $1\frac{1}{2}$ in apart. Parts of any roots standing "proud" of the periphery of the "carriage" are cut off by a guillotine arranged lengthwise along the cylindrical surface of the "carriage". As each quadrant comes into position at the base of the hopper more beets are carried along until the whole of the sample has passed through the saws. A fine pulp or "brei" is obtained and this is thrown against the surface of a revolving brass drum from which it is collected by the scraping action of a suitably shaped tray, placed

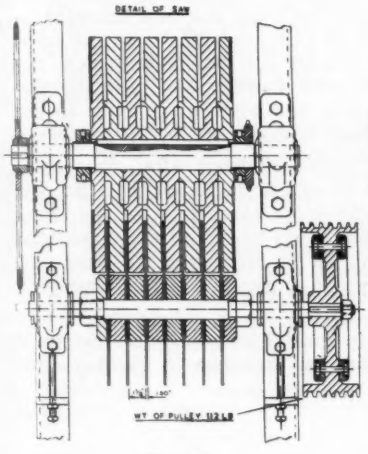

Fig. 3*a*

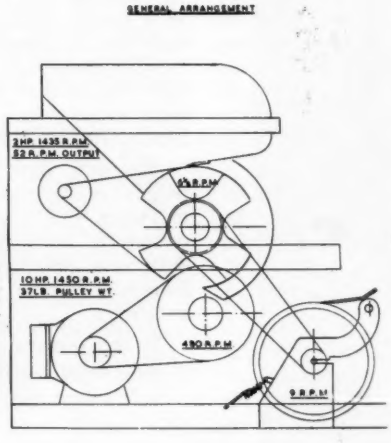

Fig. 3*b*

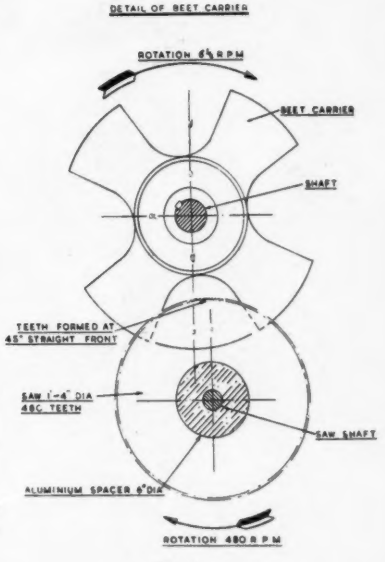

Fig. 3*c*

This method, although cumbersome and time-consuming, is fundamental and is suitable only where analysis is by the normal hot water digestion method (H.W.D.) or by the cold water digestion (C.W.D.) method, if a macerator (described later) is used. It has invariably been employed by us as the standard of comparison for the results obtained by other methods. For this purpose the remainder of the roots after preparation of the samples by the other methods are used. The term "minced remainders" has been applied to samples so prepared.

The machine is fitted to run at two speeds, the lower of which is 155 r.p.m., and this is the speed used. It is important that the knives are kept sharp and the discs renewed at the slightest sign of wear. The optimum size has been established as $\frac{3}{16}$ inch for the holes.

in a horizontal position tangentially to it. The cut pieces of roots fall by gravity through the open base of the machine and are discarded. Details of the construction of the machine are given in Figs. 3 *a*, *b* and *c*.

Fig. 4 is a photograph of a complete machine showing removal of the "brei" from one sample (for which a flat rubber "squeegee" is used) before the next sample (poised ready) is tipped into the feed hopper.

The machine was developed primarily to eliminate the human element involved in the "rasping" system formerly carried out in B.S.C. tarehouses. This involved a reduction of all samples by a process of "grading" which also depended entirely upon the human element and neither operation was ever considered as satisfactorily carried out all the time.

In designing the machine it was soon found that great attention had to be paid to every detail, and especially to the speeds of the saws and carriage, the positioning of the brei collecting drum, the size and pitch of the teeth of the saws and the type of steel used in their manufacture. Saw blades with "set" teeth were at first used but their life was short, and they are now made from a much harder steel. This, however, cannot be "set" and the blades are consequently "hollow-ground" to give the necessary clearances when cutting. Some of the theoretical

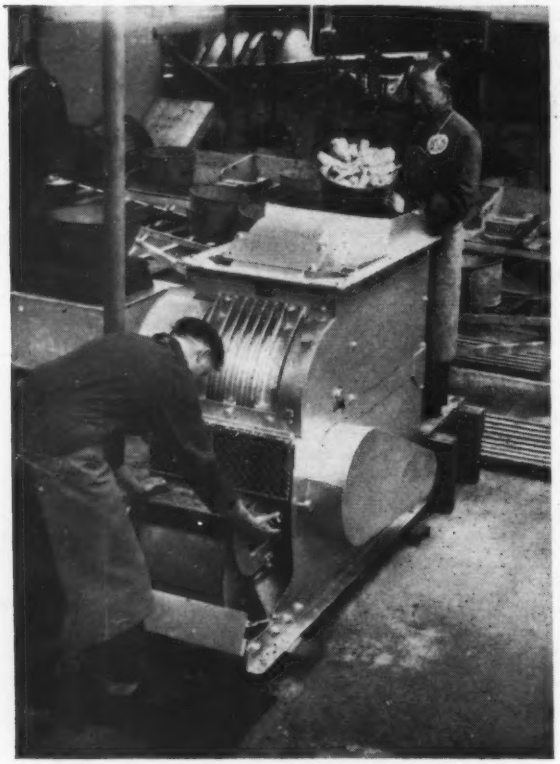

Fig. 4. Multiple Saw Machine.

considerations underlying the decisions as to speed, steel specifications and blade design will be dealt with in a further article. In the meantime, it is sufficient to remark that the speeds etc. stated in the sketches were decided upon in order to give a result on the whole as close as possible to that previously obtained with the very slow rasping and grading process when every beet had to be dealt with individually and to avoid having a large bulk of brei which then had to be laboriously reduced to a reasonable amount for analysis, as was the case when rasps were used.

The speed of 480 r.p.m. for the saw blades was arrived at by taking tests at various speeds and interpolating the results as shown on the graph (Fig. 5).

It is not the intention in this article to give details of the numerous tests made. Suffice it to say that in the trial runs at five B.S.C. factories with the new machines the average differences in sugar content between rasped beets and the same beets after sawing on over 6000 samples was only 0·013%. The pulp is just as readily extracted by the normal C.W.D. method, but still requires examination to remove small chippings before being used for analysis, although these are far fewer than was the case with rasping.

As with other types of mechanical appliances used for this purpose, the cutting tool cannot be expected to have the same reaction on all types of roots nor at the various stages of growth, and this was found to be so with the new machine. As in the case of the rasps "minced remainder" tests were carried out daily. This was done to determine the useful life of blades, which was found to vary from about 7000 to about 15,000 samples, although in isolated cases blades required changing as low as 5000 samples while others have dealt with over 20,000 samples before being discarded. It should be mentioned that the average life of rasps determined over the years in a similar manner was very low and accepted as between the limits of 1500 and 2000 samples only. In this connexion blades can be re-sharpened, but this reduces their overall diameter and generally also their useful life. It is not now our practice to use blades that have been re-sharpened more than once.

We now have ample evidence after four campaigns' experience at all our factories that the new machines give a very close assessment of the sugar content of beets purchased under all the conditions that have obtained so far from year to year and from one area or point to another in the same year in Britain.

In this connexion special mention must be made of the value of the saw machine in dealing with

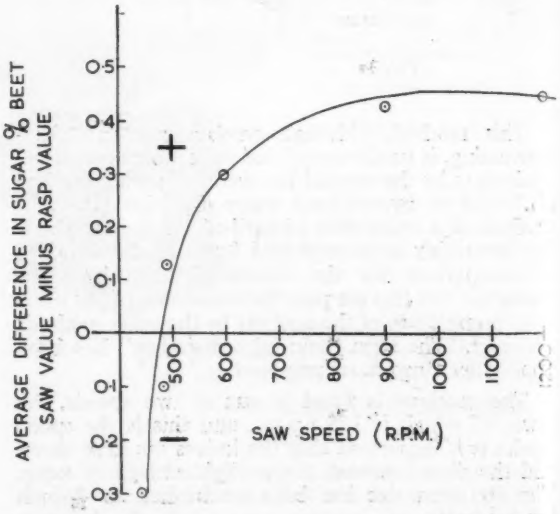

Fig. 5. Effect of Saw Speeds on Sugar Contents of Roots.

deteriorated beets resulting from frost damage. Under these conditions the results were found to be very much closer to actual sugar contents than with rasping, which gave results that were very wide of the mark, especially in those cases when the stage of decomposition was well advanced.

(B) *From Sliced Roots or Cossettes*

For many years samples of cossettes were prepared for analysis by Method I, described under (A), for analysis by the H.W.D. method. With the object of eliminating time and effort, many attempts have been made to find alternative means of preparation to which the quicker C.W.D. method of analysis could be applied, including a top-drive macerator, juice expression and a beater mill, of which the last-named gave most promise. This was an 8-inch Christy and Norris machine running at 8000 r.p.m. and fitted with a special beater cross to give minimum clearance. Screens with apertures of 1/16th, 3/64ths and 1/32nd inch respectively were tried out, and the resulting "brei" tested for sugar content by H.W.D. and by C.W.D. for comparison against the results, using the "minced remainders" technique. Dry substance determinations were also made because temperatures of the "brei" were found to have risen in each case and it was feared that some evaporation would have taken place.

It was found that the 3/64-inch grid gave, on average, results by the C.W.D. method in very close agreement with those of the same samples after mincing and analysing by the H.W.D. method. The brei produced was not, however, sufficiently fine to ensure that all the sugar passed into solution as evidenced by comparative tests made by C.W.D. and H.W.D. methods of analysis, but the loss of moisture due to an appreciable temperature rise during pulping appeared to compensate for the lack of diffusibility. The finer the grid used, the greater the temperature rise. No time was saved in preparing samples as compared to mincing.

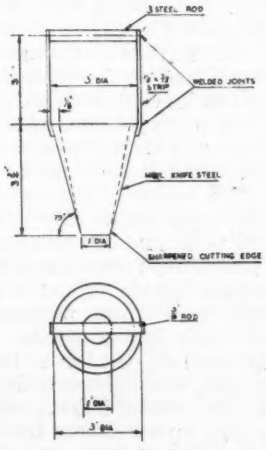

Fig. 6.

The only advantage the apparatus offered was that the C.W.D. method of analysis could be applied if a 3/64-inch grid is used. However, since the results were shown to be dependent upon compensating factors it was not adopted.

Macerators, which have recently been introduced in a number of countries and are now being more widely used, have been investigated and the type now adopted officially in our factory laboratories is known as the "Atomix". The apparatus will be described in detail in a subsequent article on this subject. The problem of easy and quick preparation of aliquots from bulk samples sufficiently small to be manageable and representative presented a problem. A "wad-punch" type of sampler was designed to overcome this difficulty and details of this are given in Fig. 6.

The cossette (or minced beets) sample is spread out quickly and evenly on a non-absorbent surface such as rubber or plastic material. This should not be a hard substance otherwise damage to the cutting edge of the punch may result. The wad-punch is pressed into the mass at right angles to the surface at a convenient number of points until full, the process being repeated, if necessary, until the required size of sample is obtained. From cossettes this gives short lengths which can be more easily mixed to give a representative aliquot.

This method has been found very satisfactory, the only precautions necessary being that the punch must be kept clean and dry when not in use and the cutting edge kept very sharp to avoid the possibility of any juice being expressed from the sample.

As a matter of interest, pressed pulp also is sampled for analysis in this manner.

ACKNOWLEDGMENTS

The author wishes to express his thanks to the Directors of the British Sugar Corporation Ltd. for permission to publish this work and to all those members of the Chemical Control staff who assisted in the investigations.

Hungarian Production, 1957/58.[1]—The eleven factories produced 266,688 metric tons of sugar, raw value, in the 1957/58 campaign, from a total of 1,769,030 metric tons of beet, a recovery of 15·58%. The area contracted for the 1957/58 campaign was 110,300 hectares and the target for 1958/59 is 105,000 hectares.

* * *

Polish 1957/58 Campaign Results.[2]—The 1957/58 crop yielded 7·6 million metric tons of sugar beet and 1,060,000 metric tons of sugar, tel quel, according to an official statement. The latter amount is composed as follows: 1,010,000 tons of white sugar, 40,000 tons of raw sugar and 10,000 tons of yellow sugar. As a result, Poland is in a position to export a total of 230,000 tons. Some 50% of the area for Spring planting has already been contracted to sugar factories.

[1] F. O. LICHT, *Int. Sugar Report*, 1958, **90**, (1), 5.
[2] F. O. LICHT, *Int. Sugar Report*, 1958, **90**, (Supp. 2), 10–11.

Know Your Clarification Station. E. D. JENSEN. *Proc. 24th Conf. Queensland Soc. Sugar Cane Tech.*, 1957, 201–210.—The strain imposed on the clarification units by increased crushing rates and extraneous matter is discussed. Emphasis is laid on the importance of adequate mixed juice–lime reaction time (15–20 min) and on automatic temperature control of heated juice (218–220°F) and adequate flash tank dimensions to ensure elimination of all air from the bagacillo particles. Bach subsider operation is discussed with emphasis on the proper use of the test cock. Also mentioned are filter operation, and losses due to deterioration of juice stored during week-end shut-down. At Racecourse mill the clear juice in the subsiders is sent to the evaporator and concentrated to syrup ready for start-up. The mud and juice from one subsider are run into an open tank and then pumped to the other subsider for storage, lime being added as the mud is pumped and solid sodium bicarbonate when dirty juice is being pumped. The empty subsider is then cleaned. Opening the subsider lids lowers the temperature to 180°F. Purity drop over the week-end is about 2 units.

* * *

The Effect of Condition of Cane Supply in Mackay District. MACKAY SOC. SUGAR CHEMISTS. *Proc. 24th Conf. Queensland Soc. Sugar Cane Tech.*, 1957, 9–15. The losses to millers caused by application of the c.c.s. formula to badly topped and mechanically-harvested cane are discussed. The greatest difficulty experienced is with badly topped cane, determinations made at Mackay factories showing that tops often constitute at least 10% of the gross weight of the cane. It is pointed out that little of the juice in the tops is found in the front roller juice taken for analysis. A loss of 375 tons of pol in milled leaf blade and trash was calculated for a period of 19 weeks at Marian mill, where the quantity of soil in cane carrier droppings alone amounted to 1220 tons during the season. Comparative data are tabulated for 1954 and 1956 c.c.s. returns from clean and dirty cane. Suggested remedies include: strict supervision of harvesting, especially for extraneous matter and burning; the return of cane in unsatisfactory condition; penalties for 3% or more extraneous matter, the amounts being credited to the factory as equivalent sugar weight; and a mixed juice weighing system for assessing sugar entering the factory, on which to base the total c.c.s. units.

* * *

Determination of Flue Gas and Combustion Air Volumes for Bagasse-Fired Boilers. E. H. HARDY. *Proc. 24th Conf. Queensland Soc. Sugar Cane Tech.*, 1957, 233–240.—The author demonstrates how the volume of the combustion air of flue gas can be calculated using his previously explained methods and tabulations[1] to obtain the weight of the products of combustion with induced draft and convert these to volumetric measurement for fan capacity. The weight:volume ratio at N.T.P. of the various gases involved is tabulated, and a formula given for the actual volume under any given conditions. A typical example of such a calculation is worked out. A formula is also given for a correction factor for negative fan pressure, although it is pointed out that the difference is so slight that it may be neglected in most cases. The calculation of the weight of air required for bagasse combustion with forced draft is explained in detail, the computations again being based on the author's previously explained methods. Correction factors for temperature and pressure are tabulated and formulae developed. Charts plotted from a series of determinations are included for quick reference.

* * *

A Truck Spotter for the Cane Tip at Kalamia. K. P. CRANITCH and D. J. MUIR. *Proc. 24th Conf. Queensland Soc. Sugar Cane Tech.*, 1957, 241–248.—To eliminate the arduous task of pushing cane trucks by hand from the truck stop at the cane carrier to the cane tip at Kalamia factory, an overhead spotter capable of pushing a fully-loaded truck to the cane tip by means of a boom was designed and put into service in October 1956. The overhead trolley runs along rails supported by tubular trusses and consists of two steel plates between which is the axle carrying the tubular boom, the pushing face of which is flat to prevent penetration of the cane. During operation the boom rides over the load on the succeeding truck, falling behind the load to be pushed, the trolley moving by means of an endless chain attached to its front and back and passing over a wheel at each end of the frame, the span between these wheels being 35 ft. The chain wheel at each end of the frame is powered by a 3 h.p. motor. The control gear consists of a master switch which may be used to stop the trolley at any point and one cam controller with a self-centring handle for forward and reverse movement. The forward section of the circuit is interlocked with the truck stop, preventing forward motion until the truck stop is opened. As a result of the use of this machine, the labour force has been reduced by one man, also lightening the tasks of the remaining team. Occasional hold-ups in the flow of trucks over the cane tip are caused by defects in the

[1] *I.S.J.*, 1957, **59**, 19.

chain and claw system of holding the load on the trucks, which add to the time the truck is on the tip and considerably increase the cycle. Suggestions are made for a system of feeding trucks so that slack hooks would allow easy uncoupling, a method of maintaining a gap between trucks to allow a man to work in safety, and a positive chain release gear for use on all trucks whether tight or slack.

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Rotary Cush-Cush and Juice Mixing Tanks at South Johnstone. THE ENGINEERING STAFF, SOUTH JOHNSTONE MILL. *Proc. 24th Conf. Queensland Soc. Sugar Cane Tech.*, 1957, 249–257.—New units installed at South Johnstone in 1956 to replace old arrangements comprised a new 6-inch chokeless pump, later modified, placed at the juice outlet of No. 1 mill bed, a new rotary juice strainer, and two new 1400-gal juice mixing tanks. The strainer is of 3 ft dia. and 8 ft 8 in long, with a stainless steel gauze of 270 1 mm–dia. holes/sq. in. The framework is mounted on a 4 in shaft, which is inclined at 7°. Juice from No. 1 and No. 2 mills is pumped by separate pumps from each mill into the strainer and falls through the screens to a receiving trough, whence it flows to the mixing tanks. Bagasse passes by gravity out to the No. 1 intermediate carrier. The strainer is motor-driven at 26 r.p.m. via gearing with a total reduction of 56:1. The screens are cleaned approximately twice a shift by a steam pipe. Juice is delivered to the inside of the juice inlet box in the mixing tank where a steel baffle directs it to the bottom of the tank, lime being added in the box. A 5 h.p. 960 r.p.m. motor mounted vertically on top of the tank is fitted with a shaft and propeller for agitation of the juice and lime. The pH meter electrodes are situated in the overflow about 4 ft from the lime distributor. Juice level in No. 2 tank is maintained by means of a float controlling a valve to the pump suction. Advantages of the new system are: marked improvement in cleanliness of the straining equipment and more floor space available, due to elevation of the strainer; clearer juice from the subsider overflow, as shown by results of analyses; less maintenance than with the scraper type, galvanized bolts having been replaced by brass bolts to determine if wear in 1956 was caused more by the sand friction than by the acid action of the juice. The average fibre content was 5·23 g dry fibre/gal screened juice as opposed to 6·60 with two fine and one coarse screens, and 9·25 with three coarse screens (flat paddle-type scrapers). In 1956 the rotary strainer had three fine and one coarse screens, but now has three fine and one elongated staggered pattern screens (the latter having 105 holes/sq. in., 2·64 mm × 0·5 mm). Tests carried out after installation of the elongated screen showed an average fibre content of 4·59. Other results from the 1956 season are: 3·38 tons filter cake/100 tons cane; 2·14 pol of filter cake; 0·53 pol lost % pol in cane; screen area to supply necessary added bagacillo 7½ sq. ft.

Corrosion of Iron and Steel. K. C. DUFFY. *Proc. 24th Conf. Queensland Soc. Sugar Cane Tech.*, 1957, 259–266.—The chemistry of iron and steel corrosion is discussed and methods of combating rust are described. These include anodic, cathodic, and adsorption and vapour phase inhibitors, water cooling systems and steam boilers being successfully maintained in a rust-free condition by the use of such inhibitors as sodium chromate, sodium nitrite, phosphates, silicates, etc. The value of painting in the cane sugar factory, where severe corrosion is caused by splashing dilute cane juices and moist and incompletely burnt bagasse, is mentioned, proper preparation of the surface before painting being emphasized.

* * *

A Study of the Sugar Factory Performances in the Philippines and other Countries. J. P. STO. DOMINGO. *Sugar News* (Philippines),1957, **33,** 220–229.—Factory performances of fourteen countries besides the Philippines are discussed and technical data tabulated. The Philippines low mill extraction is attributed especially to: high crushing rate, low water maceration, inadequate cane preparation, and poor hydraulic pressure systems. The need for high quality cane in the Philippines is emphasized.

* * *

Laboratory Design. G. W. GREENWOOD. *Sugar J.* (La.), 1957, **20,** (1), 13–15.—The size, location and arrangement of sugar factory laboratories are discussed, and the principal factors affecting choice of location are listed.

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The Australian and Fijian Sugar Industries. R. J. LEFFINGWELL. *Sugar J.* (La.), 1957, **20,** (1), 16–18 38.—A review.

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Dust Explosions in the Sugar Industry. A. WEGNER. *Zeitsch. Zuckerind.*, 1957, **82,** 219–222.—Dust explosions which have occurred in German sugar factories since 1892 are reviewed and theories on the causes of such explosions are discussed. Danger of explosions in white sugar silos exists where the sugar falls from a great height from the conveyors, clouds of dust forming thick enough to exceed the upper explosion limit for sugar dust–air mixture. Especially dangerous is the starting and stopping of the conveyors, which must therefore be done outside the silo. The need for good earthing of all metal parts, especially distributor plates, and for insulating shoes, besides the necessity of suitable clothing, is emphasized because of the electric charges on the sugar dust particles. 65% is regarded as the lowest safe R.H., at which the sugar particles adsorb water vapour which provides sufficiently high surface conductivity to prevent electrostatic charges.

BEET FACTORY NOTES

The Strontium and Barium Method for Separating Sugar from Final Molasses. A. I. SKIRSTYMONSKII, *Sakhar. Prom.*, 1957, (4), 12–19.—The strontium and barium methods of sugar separation are reviewed, and the power consumption for the recovery of the oxides calculated, the heat and electricity losses in the electric furnace constituting perhaps 15–20% of the overall electricity consumption. For treatment of 300 tons of molasses a day (150 tons of sugar), 7800–8000 kW is given as the electrical power necessary for recovery of the barium oxide alone, this figure depending greatly on the quality of the original barium salts and on the amount of lime in the molasses. The two methods are used side by side at the Dessau factory in East Germany, the large amount of steam for the strontium method ensuring the production of enough electrical energy to increase the recovery of sugar by 35–40% using the barium method. The recovery of barium oxide according to the Deguide process, used at the Johnstown (Colorado) sugar factory, is described. A diagram of this scheme, which does not require high temperatures, is given, besides one of the simpler method used at Dessau and in the Italian factories. This consumes more electrical power although it is claimed to be more economical, needing less labour and equipment and less process steam. The non-sugars are filtered off from the barium saccharate into a saturater, after which they are evaporated to 75% dry solids, the saccharate entering another saturater, where the sugar is dissolved. Further $BaCO_3$ is filtered off into a rotary-drum filter and is dried off together with freshly prepared $BaCO_3$ in a rotary kiln to which carbon or coke is added. The BaO is recovered from the dried material in an electric furnace. The results of recovery of BaO from the carbonate at 1000°C are shown graphically besides those of experimental recovery with and without use of carbon and hydrogen. The installation at one of the existing factories of an experimental separation plant capable of producing 30–40 tons of sugar a day using the barium method is advocated.

* * *

Some Problems of Juice Purification. J. DOBRZYCKI. *Gaz. Cukr.*, 1957, **59**, 142–147.—The pre-defecation, defecation, and first and second carbonatation processes are reviewed with 26 references to the literature.

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The Burning of Fine Limestone. D. S. SHEVTSOV *et al.* *Sakhar. Prom.*, 1957, (4), 20–24.—A vertical shaft kiln in which it is possible to burn limestone of 20–100 mm is described and illustrated. Tests carried out at the Bobrovits sugar factory in 1956 were satisfactory, the burning of the lime being the same at the top of the kiln as at various sections. The CO_2 content of the exhausted gas was 28–32%, the fuel consumption being 8% by weight of the stone. Burning of fine limestone means that quarrying, crushing and sorting of the limestone can be fully mechanized, with a consequent cut in the manufacturing costs. Certain measures to be taken with conversion to fine limestone burning are recommended.

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Diffusion Water Return to the Diffusion Battery in the Light of a Whole Campaign's Experience. T. PIETRZYKOWSKI, S. GODWOD and Z. ZAREBA. *Gaz. Cukr.*, 1957, **59**, 157–162.—Water distribution and balance at Chybie factory in 1955 is described with the aid of a flow sheet. Diffusion juice was treated with antiseptics (e.g. formalin) and depulped before returning it to diffusion without further treatment. Depulping by simple decantation was better than in a Rolfoff depulper which lowered the pH. Pulp-press water was purified by defeco-saturation before return, mechanical purification being inadequate. Results showed that recycling of the water only slightly reduced the purity and had no effect on later processing, although the amount of molasses increased. Corrosion in the diffusion water and pulp press water pumps was more extensive than previously. Temperature and pressure data and other details of the diffusion and pulp-press water before and after depulping are tabulated with other factory data.

* * *

Improvements in Rotary Diffuser and Vacuum Filter Performance. I. E. ZINGEL'. *Sakhar. Prom.*, 1957, (5), 21–25.—Modifications to a 4·8 × 25 m Mandryko rotary diffuser at Krasnyansk factory are described. Reduced spillage from the diffuser tail, the treatment of thinner cossettes (15–18m/100 g), a mean draught of 108·1% (compared with 121·6%), and an increase in throughput of 400 tons/day of beet, were made possible by replacing the diametric screens with stronger lateral and cylindrical screens. To prevent cossettes blocking the juice feed pipe to the preheaters through breaking of the screens in the head, a juice exhaust valve was installed in the head. A special bin was installed under the diffuser head to collect spilt foam; this is limed and hot carbonatation juice added, after which it is returned to pre-defecation. Further modifications to be made are enumerated. Performance data for the latter half of 1956 are compared with those for 1955 (before modifications). Sugar recovery was 11·86% by wt. of beet (10·54% in 1955), sucrose losses in pulp 0·50% (0·47%) and undetermined losses 0·39% (1·56%). Improvements in the filter station include sending rotary vacuum filtrate direct to second carbonatation instead of to first carbonatation filter presses, replacing plunger pumps with centrifugal pumps for muds to the rotary filters, and increasing the number of rotary filters and filter presses to four of each type. One result was that 3·23 sq. m. filter cloth in the filter presses was used per 100 tons as opposed to 6·44 sq. m. formerly. (In the case of cotton cloths 2·25 sq. m. compared with 4·25 sq. m. in 1955). Sugar losses in mud were 0·19% in 1956 compared with 0·22 in 1955.

NEW BOOKS AND BULLETINS

Technology for Sugar Refinery Workers, 3rd Edition. Sir O. LYLE. 663 pp; 5¼×8¾ in. (Chapman & Hall Ltd., 37 Essex Street, London W.C.2). 1957. Price: 70s 0d.

This well-known manual is presented to the sugar world in its third edition. This book does not need an introduction to the sugar technologists who are familiar with the modern literature on sugar technology and sugar refining. It is one of the few books we have available at the present moment which gives us an excellent review of the different phases of sugar refining, presented in a way that it is not only of value to the chemist and the operator, but also to the engineer and the economist in our industry.

It is unusual to find an author with this exceptional combination of being an authority in the field of engineering and technology as Sir OLIVER LYLE. He deserves the gratitude of all who are members of the fraternity of sugar technologists by the generous way he has made his experience and knowledge available to others. But this attitude of a writer is combined with an ability to express himself in such a way that his ideas on steam economy are not only easily understood, but become a fascinating subject for the chemist.

I feel certain that his description of the technology of different processes will be read with appreciation by the mechanical engineers who are connected professionally with the sugar industry. The cleavage we can occasionally observe in the way of thinking and approach towards the problems of sugar manufacture between engineers and chemists does not exist in the presentation of Sir OLIVER LYLE. I do not know whether Sir OLIVER feels it as a distinction if we describe him as one of our masters in the field of teaching.

This book is not a manual for sugar refining as it is practised in different countries by different processes; it has been written particularly in connexion with the history of the Plaistow Wharf refinery.

It must be realized that at the moment, the amount of cane sugar that is refined over the whole world amounts to approximately two-thirds of the total cane sugar production. A part of this sugar is refined exclusively with vegetable carbons as main refining agent. Another part is made by the phosphatation process in combination with decolorizing agents, physical or chemical in nature. The amount of sugar refined by the use of bone char in Europe, America and Asia amounts altogether to about one-third of the total bulk world cane sugar production.

The "Technology for Sugar Refinery Workers" describes primarily the processing of raw cane sugar by carbonatation as the first purification process, followed by bone char. But all the other technological processes involved in sugar refining as washing of the raw sugar, crystallization, centrifugation, washing drying and grading of sugars have all so much in common that the experience of one refinery, if it is analyzed in the critical objective way as done by Sir OLIVER, has its practical use for all sugar refineries.

The practical significance of this book is that one of the leading sugar refining companies of the world gives us a complete picture of how they are operating in one of their biggest refineries and makes this experience available to all the others. This is a liberalism of the mind that is very exceptional among leaders of industry.

With all the lip service that is given today as to the free exchange of ideas and experience and bringing to others the know-how, to let them share in what we have found as progress by our endeavours is for Sir OLIVER LYLE not only a story of telling about the know-how, but also giving at the same time the explanation where certain practices are used. It is always the combination of the know-how and the know-why.

It is also undoubtedly based on the intelligent attitude of a man who has the fullest confidence in what he and his collaborators are doing and trying to achieve, namely that the objectivity and the combination of required knowledge, analyzed by scientific methods, hard work and the willingness to share his views with others in the highest sense of responsibility gives an organisation a place in the world which will be strong enough to hold its own against all that may be given as criticism by outsiders.

The book by OLIVER LYLE is a monument in the sugar industry where we have received an example of first-class engineering, managerial organization and scientific approach.

We wish to express the opinion that all those connected with the sugar industry can benefit by studying what has been given to us in this masterful review. The development of the sugar industry is not only a matter of higher politics, protection and all kinds of governmental rulings, but it is also, and it has to be in the first place, the result of the progressive spirit of technologists who are not only experts in a limited field, but who have the vision to intertwine in a harmonious way the different phases of the sugar production process from the raw material to the commercial product going to the consumers.

This is a book that should be on the desk and not only on the library shelves of every sugar technologist who desires to be qualified as a recognized authority in his area where by Providence he has been given the distinction of being a guide or a directing spirit.

PIETER HONIG.

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Sugar y Azúcar Yearbook 1958. 304 pp; 9×12 in. (Sugar Publications, 604 Fifth Avenue, New York 20, N.Y., U.S.A.). 1958. Price: $5.00: £1 15s.

The latest edition of this interesting yearbook contains the customary review of recent technical progress in the sugar industry, by O. W. WILLCOX, which

covers agriculture, factory technology and books. This, like the 1956 extension of the 1948 U.S. Sugar Act, and the account by R. H. SHIELDS and P. E. JONES of its operation in 1956/57, appears in both English and Spanish. The section containing short descriptions of new products, and a comprehensive Buyers' Guide, also appear in both languages. A short section of U.S. and world sugar statistics appears only in English.

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1957 Reports, Hawaiian Sugar Technologists 16th Annual Meeting. 160 pp; $7\frac{3}{4} \times 10\frac{3}{4}$ in. (Hawaiian Sugar Technologists, c/o Experiment Station, H.S.P.A., Honolulu 14, Hawaii). 1957.

The inside front cover and inside back cover carry lists of officers and committee members of the Association, while the last page of the book lists the officers for individual islands. Apart from a table of contents, the remainder of the volume comprises the texts of the papers read at the 16th Meeting in November 1957.

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Gospodarka Surowcowa w Przemysle Cukrowniczym. [Handling of Raw Materials in the Sugar (Beet) Industry]. J. JANOTTA, B. PERETJAKOWICZ, Z. SRZEDNICKI and B. SWIATKOWSKI. (In Polish). 115 pp; $5\frac{3}{4} \times 8$ in. (Gazeta Cukrownicza, Warszawa 1, Czackiego 3/5, Skrytka poczt. 360, Poland). Price: 28 zloty.

This is the first of a series of publications to be produced by the Library of the Polish monthly journal "Gazeta Cukrownicza" on problems in the sugar industry. Among the topics covered in its ten chapters are: the biology of the beet; ripening and harvesting; factors in the deterioration of the harvested and stored beet, including mechanical handling, cleaning, topping, storage, and start and length of campaign; delivery and reception of the harvested beet; and estimation of the quality of the beet and sucrose losses. Many tables of data gathered from past Polish campaigns are given.

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Handbook of Chemical Data. Ed. F. W. ATACK. 629 pp; 4×5 in. (John Sherratt & Son, The St. Ann's Press, Park Road, Altrincham, Cheshire). 1957. Price: 36s 0d.

The publishers describe this as a portable but complete reference book for chemists, containing tables of physical and chemical constants, properties of organic and inorganic compounds and minerals, analyses, conversion and other tables, etc. This is very apt since there are many tables containing a a very large amount of information, including the Herzfeld sucrose solubility data and the Plato tables of specific gravity of sugar solutions and changes of specific gravity with temperature. A small section on analysis includes qualitative inorganic methods and quantitative inorganic methods and factors. An index covers twelve pages and is extremely useful for locating the required data from the wealth which has somehow been condensed into this very handy book.

* * *

Losses caused by Plant Diseases in the Colonies. G. WATTS-PADWICK. Phytopathological Papers, No. 1, 60 pp. (The Commonwealth Mycological Institute, Kew, Surrey). 1956. Price: 10s 0d.

In the brief section on sugar cane, classified under vegetatively propagated crops, it is stated that the disease of sugar cane that has attracted most attention in the Colonies is leaf scald (*Xanthomonas albilineans*), a disease of bacterial origin. It has given rise to much alarm in British Guiana. The disease was already widespread in the Colony when discovered in 1950. It is not considered possible to make an accurate estimate of the undoubtedly serious losses it causes, the dominant variety in British Guiana, B 34104, being particularly susceptible. However, it is believed that in heavily infected areas a loss of at least 25% in yield may be incurred.

* * *

Soils of the Sugar Belt. Part I. B. E. BEATER. 101 pp; $5\frac{1}{2} \times 8\frac{1}{2}$ in. (Oxford University Press). 1957. Price: 35s 0d.

The sugar belt, of which the survey is here recorded, is that of Natal and this first part deals with the soils of the Natal North Coast only. The work described forms part of the Natal Regional Survey carried out under the auspices of the University of Natal and the South African Sugar Association. The author is Soil Chemist to the Experiment Station of the latter at Mount Edgecombe.

A preliminary note describes the main geological features of this faulted region. Three sections follow of which the first (48 pp) deals with the pedological characters of the soils derived from the ten recognized geological series. Included here are chemical and mechanical analyses of the defined horizons of each. The second section (12 pp) is of considerable interest from the agricultural point of view, for it considers such chemical factors as available nutrients, fixation, exchangeable cations and organic matter in their bearing on relative fertility, and physical factors as erodability, ease of working and permeability. The third section (7 pp) briefly sums up the characteristics of the soils of the belt.

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Pesticides in Tropical Agriculture. 102 pp; $6 \times 9\frac{1}{4}$ in. Advances in Chemistry Series 13. (American Chemical Society, 1155 Sixteenth Street, N.W. Washington 6, D.C.). 1957.

The pamphlet is composed of 14 papers dealing with different aspects of the control by chemical means of weeds, fungoid and bacterial diseases, insect pests and rats. E. M. SUMMERS contributes one article (4 pp) on the pesticides of sugar cane. Present practice and potential uses are described and include check of inversion between crushing and processing by "Steri-Chlor 4X".

Some Hygroscopic Properties of Raw Sugar. F. H. C. KELLY. *Proc. 24th Conf. Queensland Soc. Sugar Cane Tech.*, 1957, 211–216.—Data from the experiments carried out by WEBSTER[1] on the hygroscopicity of raw sugar are expressed as an equation for the relationship between the raw sugar moisture content and the atmospheric vapour pressure $w = k(p)^m$, where w = moisture content / 100 dry substance, p = equilibrium vapour pressure in mm Hg, and k and m are constants. For observation of the relationship between k and the reducing sugar content the equation is expanded to $w = 489\ (3{\cdot}235r+1)\ (p)^{3{\cdot}79}\ (t)^{-5{\cdot}42}$, where r = reducing sugar percentage of the raw sugar and t = temperature in °C. The safe maximum moisture content for any selected pol value can be calculated from the dilution indicator equation assuming a D.I. of 40. Converted into moisture / 100 dry substance, this can be substituted for w above. In many raw sugar samples the reducing sugar varies from one-quarter to one-third of the "non-pol" and one or other of these values can be substituted for r in the equation. Calculations of maximum R.H. from water vapour pressure tables corresponding to the associated values for p and t are tabulated, r being taken as one-quarter of the "non-pol". For a range of dry bulb temperatures from 58 to 100°F, a maximum R.H. of 50% is shown to be safe for any pol value between 96 and 99° (a maximum of 55–58% at approximately 77°F with a steady fall of 2–3% for every 10°F in either direction). The R.H. will exceed the safe limits under certain storage and loading conditions but the rate of change of raw sugar moisture content is not high, although accurate data are lacking on this point. A temperature function may replace the pressure function in the equation by substituting another equation of three connecting water vapour pressure p with t for various temperature ranges. Calculation of the heat of condensation (or evaporation) of the water in the raw sugar is demonstrated using data from the log–log graph of the equilibrium moisture conditions. From values calculated for 30–40°C it is shown that the heat of solution in the water condensing on the raw sugar crystal is intermediate between those of sucrose and of the reducing sugars, which is consistent with the existence of a molasses film on the raw sugar crystal surface containing a mixture of all three sugars.

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A New Method of Moisture Determination in Sugars. A. R. SARANIN. *Proc. 24th Conf. Queensland Soc. Sugar Cane Tech.*, 1957, 217–222.—A 15-min method for direct measurement of the moisture content of raw and refined sugar is based on the reaction of the water released from sugar (heated for 6–7 min with an infra-red lamp to 115–135°C) with calcium carbide to form acetylene gas. The volume of the gas formed is measured and a conversion factor obtained from the ideal gas laws used to give the moisture content of the sugar, knowing the weight of the sample and the temperature at which the determination is made. Results of sensitivity tests show the volume of gas collected to be 98·7% of the theoretical volume. Comparative tests using the conventional oven method and the new method gave almost identical results, the average difference over eight tests being 0·009%.

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The Application of Radio-Chemistry in Sugar Technical Research. H. HÖRNING. *Zeitsch. Zuckerind.*, 1957, **82**, 216–218.—The use of radio isotopes, especially ^{14}C, in sugar technology research is discussed. A modern radiation counter can register 50% of all transmitted rays (as opposed to 5–10% with a conventional counter), which means one-millionth of a gram of sucrose would be detectable from 40 mg of a ^{14}C-sucrose, which would send out 2·22 million impulses per min. On addition of such a quantity of ^{14}C-sucrose to 1 litre of raw juice with 120 g sucrose, 90 impulses/min would still be detectable in 10 mg sucrose. The possibility of using sugars containing ^{14}C in only certain atoms of its structure is mentioned, with a view to determining the start of degradation and its course. Thus the colour problem could probably be solved, and the albumins, amino acids, saponins and other impurities located. The pol of individual impurities could be determined instead of the sum of the saccharimeter values by passing "marked" substances of known relative specific activity through the mixture and homogenizing, after which any substance could be isolated in pure form and the now small relative specific activity measured. The recovery of ^{14}C-sucrose and of other substances containing ^{14}C is discussed.

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Electrophoretic Separation of Amino-Acids in Sugar Factory Products and Proof (of the Presence) of γ-Aminobutyric Acid and Ornithine. P. PAVLAS and O. MELOUNOVÁ-HAUSLEROVÁ. *Listy Cukr.*, 1957, **73**, 131–135.—Diffusion and thick juices from the 1955/56 campaign were submitted to paper electrophoresis at pH 5·6. The two resultant groups of neutral amino-acids were eluted and fractionated by one- and two-dimensional paper chromatography or by further electrophoresis. The less mobile group was found to contain: serine, glycine, threonine, alanine, tyrosine, methionine, valine, tryptophane, phenylalanine,

[1] *I.S.J.*, 1940, **43**, 46–49.

leucine, isoleucine, asparagine and glutamine, while the faster group contained only γ-aminobutyric acid, the isoelectric point of which was calculated from the dissociation constant to be 7·33. By means of similar electrophoresis at pH 11·5 the basic amino-acids were separated, lysine, histidine, arginine, and ornithine being identified.

* * *

The Shape of Crystallization Curves. A. MIRCEV and M. FRIML. *Listy Cukr.*, 1957, **73,** 136–139.—In crystallization tests on final molasses it was found that the crystallization graphs showing Brix vs. purity were specific for molasses from different factories and campaigns, dependent on the composition of non-sugars content. With ideal exhaustion the curve would be a straight line, and it is almost so, even though such exhaustion is not attained in practice. The four types of curves are: a straight line; a curve with a bend at 82°Bx corresponding to slowing down in crystallization, indicating satisfactory exhaustion; curves with a change at 84°Bx from inclined to almost horizontal, indicating no change in final purity on further concentration (at this point it is considered preferable to send to the centrifugals); curves which rise after the change point at 84°Bx, which indicates a decrease in crystallization at higher Brix and an increase in molasses purity, when exhaustion would be incomplete. The uses of the curves are discussed, e.g., to show when to start centrifugalling or when to dilute the molasses to aid centrifugalling. It is shown that Na_2SO_4 or $CaCl_2$ may be added to massecuites when these are dropped, to reduce viscosity, but calcium nitrate and acetate are useless for this.

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Industrial Objective Saccharimeter with Automatic Setting. A. A. ZAIKA and V. I. LITVAK. *Sakhar. Prom.*, 1957, (5), 25–27.—The "SA" photoelectric saccharimeter designed by V. I. KUDRYAVTSEV is described, and illustrated by circuit diagrams and photograph. Three quartz wedge compensators are incorporated, a 12-volt lamp is the light source, and a neon lamp serves as balance indicator. The instrument will take 400 mm tubes and is intended for use in an ambient temperature of 10–35°, and up to 80% R.H.

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Acceleration of Sedimentation in Clay Suspensions using Synthetic Organic Flocculation. H. J. FIEDLER. *Zucker*, 1957, **10,** 273–277.—In investigations of clarification of beet wash-water, "Krilium 6" (synthetic polyanion) and "Separan 2610" (high molecular non-electrolyte) were added to suspensions of 1 g kaolinite/100 cm end volume. At all pH values of the suspension the floc size and clarification was greater with "Separan", "Krilium" addition at increased alkalinities causing increased turbidity. At values above the optimal concentration of "Separan" (0·1–0·5% on clay) and with increased centrifuging time redispersion took place. At concentrations of 0·025% and 0·25% clarification of the suspension was accelerated with both agents and increased centrifuging time. At optimal concentrations of the agent, conglomeration of the particles was complete. NaCl had an inhibiting effect on both agents, this being greater on "Krilium". Ca ions caused clarification, but no floc, this effect decreasing with increased Ca content in the presence of "Krilium", but remaining constant in the presence of "Separan". CMC 70 (low viscosity carboxymethylcellulose) had a stabilizing effect on the suspension. Even in the stabilized solution "Separan" caused strong flocculation. Previous tests using high molecular polyacrylates have shown that these are also efficient floc agents as opposed to substances of lower M.W.

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Rapid Method of Bacterial Count Determination in the Sugar Industry. W. BARTELMUS and F. PERSCHAK. *Zeitsch. Zuckerind.*, 1957, **82,** 276–281.—The usual methods of bacterial determination are discussed with their advantages and disadvantages. The plate process of KOCH[1] is regarded as the most suitable method, but a disadvantage lies in the long incubation period of 48 hr. This period is reduced to 10 hr with the modified FROST[2] plate method further modified by the authors examining diffusion infection during the 1956/57 campaign. The test droplet is mixed on a slide with the culture medium, using a platinum wire, and the slide placed in a moist chamber. After incubation the slide is stained and the count made. The range of the results was very small, in one test the difference between the smallest and largest counts being only 10%. Tests were carried out at 56°, 70° and 75°. The results compare favourably with those obtained using the KOCH method, and other advantages of the method are: the smaller amount of culture medium needed, smaller number of dilutions, and the small amount of room-space required, making it especially suitable for mobile control.

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Use of "Versene" in Sugar Industry. N. A. RAMAIAH. *Indian Sugar*, 1957, **7,** 43–49.—Investigations using EDTA carried out at the National Sugar Institute, Kanpur, include the estimation of Ca and Mg ions in cane juice. Addition of cupric nitrate to give 10 mM, together with sufficient ammonia to give 2M final concentration is followed by titration with standard EDTA, measuring the optical density of the solution; when all the Ca is chelated, the EDTA chelates the Cu ions, so reducing the optical density sharply. The method was found applicable over a wide range of concentrations and the error was less than 2%. A solution of 9 g disodium EDTA, 5 g NaOH and 3·5 g copper sulphate in 100 ml was found to be a stable reagent suitable for replacing Fehling's solution in the determination of reducing sugars. Addition of EDTA and NaOH to a solution containing lead and levulose prevented formation of a lead-levulose compound which would distort the true polarization value in an easier way than de-

[1] DEMETER: Bakteriologische Untersuchungs-Methoden der Milchwirtschaft. (Ulmer, Stuttgart), 1952.
[2] *J. Infect. Diseases*, 1921, **28,** 176.

leading with oxalic acid, etc. The rate of filtration through clogged filtercloths is also improved by treatment with a 2% solution of EDTA.

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New Reagent for Estimation of Reducing Sugars. K. S. G. Doss, S. C. Sen and J. P. Bansal. *Sugar y Azúcar*, 1957, **52**, (6), 33.—The use of a solution of EDTA, NaOH and $CuSO_4$ as referred to above is described.

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Methods for Count of Micro-organisms in Liquid Sugar. H. E. Halden. *J. Amer. Soc. Sugar Beet Tech.*, 1957, **9**, 393–399.—Accurate micro-organism counts are necessary in liquid sugars because of control programmes during storage and transport and so that specific limits may be established for consumer acceptance. In the plating technique, an excessive number of plates is necessary for accurate counts at low average levels, but a new filter membrane technique[1] shows promise.

* * *

Measurement of Salt Content of Beet Juices by Total Acidity. H. S. Owens. *J. Amer. Soc. Sugar Beet Tech.* 1957, **9**, 466–467.—A column containing 10 ml of wet "Dowex-50" resin, regenerated with 5% H_2SO_4 and washed with ion-free water to an effluent pH of 6 or over is treated with 10 ml of beet juice adjusted to about 10% sucrose. The column is washed with 20 ml ion-free water and the total volume made up to 50 ml of which a 10 ml aliquot is titrated with 0·1N NaOH. Such determinations are considered useful as a guide for beet breeders in eliminating low-sugar beets.

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Determination of certain Qualities of Individual Consignments of Cane. III. The Significance of Brix-free Water in the Analysis of Cane and Bagasse Samples. C. van der Pol, C. M. Young and K. Douwes Dekker. *S. African Sugar J.*, 1957, **41**, 544–548.—It is shown that Brix-free water is a component of the fibre in cane and cannot be ignored as is erroneously done in the "Absolute Juice" concept, viz. 100 - fibre% = absolute juice%. Results of experiments to determine the Brix-free water % fibre by a direct method have shown that it has a value of about 30%. Hence it appears that a more correct definition of "fibre" would be: the cold water-insoluble material in cane. For the purpose of finding juice % cane, the formula: Juice % cane = 100–1·3F should be used, where F = dry fibre % cane.

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Determination of Bromine Derivatives in Molasses. A. R. Deschreider and J. Frateur. *Ind. Alim. Agric.*, 1957, **74**, 541–544.—The presence of quaternary ammonium bromides in molasses used as fodder can be harmful and their determination has been studied, by both a direct extraction method and an indirect method. The latter, which is considered best for molasses, is as follows: 5 g of molasses is well mixed with 3 ml 1N KOH and dried on a hot air bath under an infra-red lamp. The dried material is charred with a micro-flame and then calcined at 480–500°C for 1 hour. After cooling, the residue is boiled with 20 ml twice-distilled water, filtered and washed with more hot water. The residue is again dried after mixing with 1 ml N KOH, calcined 1 hr at 480–500°C and extracted again. The combined extracts are transferred to platinum crucible, evaporated to dryness, calcined 1 hr at 480–500°C, and redissolved in a little water, neutralized by dropwise addition of H_2SO_4, and adjusted to a volume such that 1 ml contains about 0·01 mg of Br. To an aliquot (0·5–5 ml) is added water to 5 ml and then 1 ml of acetate buffer of pH 5·5; 1 ml of fluoresceine solution (3 mg in 100 ml 0·025N NaOH); 1 ml 0·1% chloramine T solution; and the mixture agitated and left for exactly 3 min. After this time 1 ml of sodium thiosulphate solution (0·5 g $Na_2S_2O_3$ and 5 g NaOH in 100 ml) is added and the solution made up to 10 ml. The colour is measured at 552 mμ using a blank determination, and the content in the molasses read off using a reference curve drawn up for a standard solution.

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Studies in the Chemistry of Sulphitation. II. A. Carruthers, J. F. T. Oldfield, M. Shore and A. E. Wootton. *Paper presented to the 10th Tech. Conf., British Sugar Corp.*, 1957.—By conversion of all sulphur compounds in molasses to sulphate, it was shown that this accounted for all the sulphur burnt in the stoves of the British Sugar Corporation factories. Stove gas analyses showed that the efficiency of conversion of S to SO_2 was high, while exit gases from the sulphur towers contained practically no oxides of sulphur. Nevertheless, only about half the sulphur could be detected in molasses as SO_2 liberated by acid; SO_2 liberated by alkali treatment followed by acid; and as sulphate. Some of the remainder is shown to be present in the form of potassium imidosulphonate probably produced via a nitrilosulphonate from nitrates and bisulphites.

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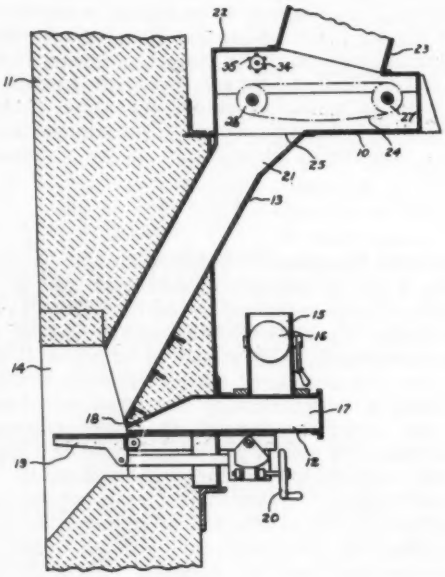
Nitrogen Balance carried out in a Commercial Sugar Factory. R. Stevens. *Proc. B.W.I. Sugar Tech.*, 1955, 86–91.—Total, amino and amide-nitrogen determinations were made on 24-hr composite samples of mixed juice, clarified juice, syrup, filter mud, sugar and molasses from Brechin Castle factory and the results are tabulated. The data show that only a small amount of the nitrogen entering the factory in mixed juice is removed in clarification, the filter cake containing chiefly protein nitrogen, and the majority passes unchanged through the factory into final molasses.

[1] Cf. *I.S.J.*, 1957, **59**, 70.

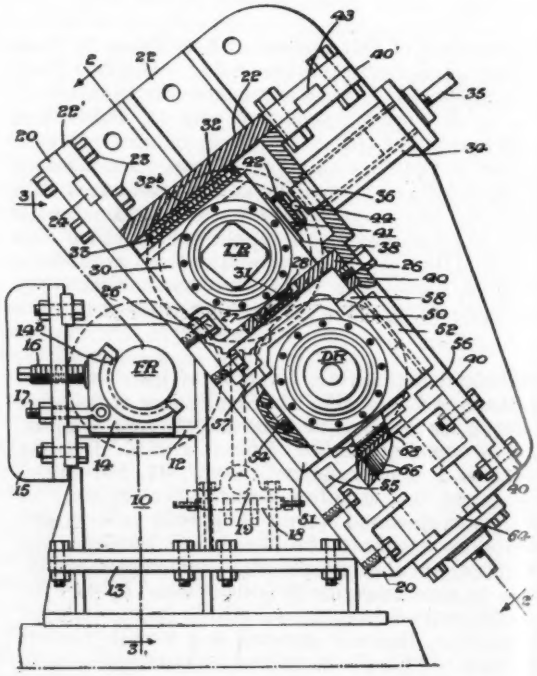
UNITED STATES

Fuel Feeder (for Bagasse Furnaces). E. C. MILLER assr. RILEY STOKER CORP., of Worcester, Mass., U.S.A. **2,792,131.** 23rd April, 1953; 14th May, 1957.—Bagasse comes from a storage hopper down the chute 23 and falls onto the endless belt conveyor 24 supported on the driven wheels 28 and the idler



wheels 27. The conveyor is of the link-belt type having raised dogs which engage with the bagasse carrying it towards the rear of the feeder where a matted mass forms. The dogs tear successive layers from this mass, which pass down the chute 13 through the gap 25. Large tangled masses of bagasse falling onto the conveyor 24 are carried to the rear where they are met by the levelling drum 34 which is driven at a peripheral speed approximately twice that of the belt 24. Teeth 35 on the drum 34 tear at the mass so giving a blanket of thickness suited to the action of the pneumatic stoker 12 which delivers a blast of air through nozzle 18 to distribute the bagasse falling on distributor plate 19.

Cane Crushing Mill. E. W. KOPKE, of New York, N.Y., U.S.A. **2,797,635.** 22nd July, 1953; 2nd July, 1947.—In a three-roller cane mill the feed roller *FR* is mounted in a bearing block 14 having a liner 14*b*. The block is mounted on the upper horizontal flange 12 of a vertical support plate 10 resting on bedplate 13. The cap plate 15 is bolted to the supporting member 10, and horizontal movement of the bearing block 14 is effected by jack screw 16 and withdrawing screw 17. The top roller *TR* is mounted in a bearing box 30 which is held in the front plate 20 by the cap plate 22 and supporting plate 26, this last being attached to plate 20 by the bolted flange 26′. A sliding block 28 moves in a rec-



tangular guideway 27, and has a circular recess into which fits a boss 31 extending from the box 30. Between the box and plate 22 is a ladder-type roller bearing formed by rollers 32 held by retainer 33 between wear plates 32*a*, 32*b*. This enables the roller to tilt through uneven loading without undue wear

Copies of Specifications of United Kingdom Patents can be obtained on application to H.M. Patent Office, 25 Southampton Buildings, London, W.C.2. (price 2s each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. (price 25 cents each).

of the bearing. Pressure is supplied to the roller through ram cylinder 34 connected to pressure plate 38 by way of a retaining cage 42 which holds cylindrical rollers 41 and 44 at right angles to each other, so that the pressure is maintained unchanged even when the roller tilts or the bearing assembly wears. The discharge roller *DR* is mounted in a block 50 which is fitted with trunnions 54. These fit into corresponding sockets in U-section slipper plates 51 and 52 which overlap and slide along the front and back frame plates 20, 40 between the limit blocks 55, 56, 57 and 58. The trunnion arrangement enables the mill to operate with the discharge roller tilted, and pressure from the ram piston 66 is maintained in this position by coupling with the block 50 by way of roller 68. The turnplate supporting box 19 is mounted on the supporting bracket which is mounted on the main support plate 10. A feature of the design is that the movement of the bearing block about the axis of the rollers permits the use of roller bearings.

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Method of Evaporating Solutions to obtain a Constant Density Concentrate. P. HONIG, of Elmsford, N.Y., U.S.A. and J. K. LING, of Malang, Indonesia. **2,800,955.** 22nd April, 1952; 30th July, 1957.—The weight of water evaporated W in concentrating a quantity G of juice is given by $G\frac{(b_s - b_j)}{b_s}$, where b_j and b_s are the densities of the juice and syrup respectively. The value of the factor $(b_s - b_j) / b_s = k$ can be calculated for chosen values of the two densities and is equal to W/G. In a multiple effect evaporator, the value of W can be taken as the sum of the condensates produced from a quantity G of juice. In the system claimed, the quantity and density of juice flowing into an evaporator are measured, as is the combined quantity of condensate produced, and the information fed into an automatic ratio regulating apparatus which increases or decreases the steam supply in accordance with increases or decreases in the value of k so maintaining a constant syrup density. The juice flow may be decreased to compensate for losses in heat transmission through scaling or fouling of the heating surfaces. Provision is also made for adjusting the predetermined ratio so as to obtain constant density syrup of a different concentration.

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Dehydrating Molasses. C. VINCENTY, of Rio Pedras, Puerto Rico, assr. GOVERNOR OF PUERTO RICO. **2,801,174.** 20th July, 1951; 30th July, 1957.—Molasses (30–70 parts) and fluid yeast cream (70–30 parts) are heated prior to mixing at a temperature of 140–150°F so as to reduce viscosity and provide a free-flowing liquid mixture. This is passed continuously over a moving drying surface in the form of a thin film (e.g. a drum dryer), at a temperature of 215–330°F, sufficiently high to destroy the yeast enzymes and kill the cells, until the moisture content has been reduced to 2–10%, and a friable product is obtained. It is then removed from the drying surface. The mixing and drying are carried out in the absence of fermentation.

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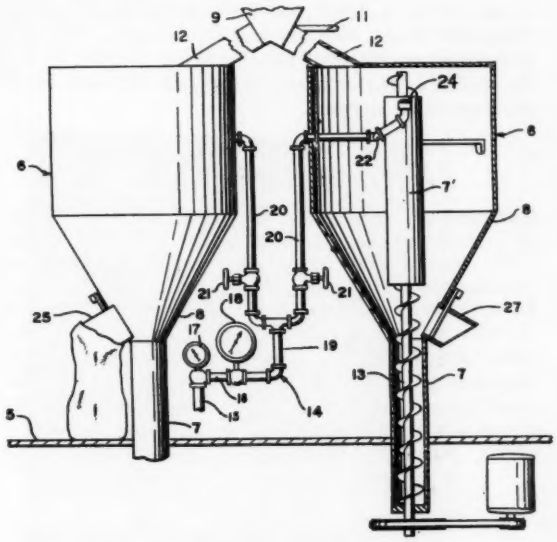
Mixing Feeds with Molasses. R. F. RIEGEL, of Greenville, Ohio, U.S.A. **2,801,832.** 18th July, 1955; 6th August, 1957.—Ground feed is delivered under pressure to dust collector 9 and passes by gravity to one or other of the mixers 6. It falls to the bottom of casing 8 and is taken by screw conveyor 7 through



conduit 7'. Molasses (of up to 79·5°Bx without heating) is pumped through pipe 15 to the corresponding pipe 20 and is sprayed through nozzle 24, forming a layer on the feed, which is discharged by the screw and falls to the bottom of the casing. The operation is repeated continuously until a desired mixture of molasses and feed is obtained when the molasses flow is stopped and the mixer discharged by outlet 25 or 27 to bags. The spray nozzle is directed upwards to effect optimal coating and to prevent dripping of molasses when the valve has been closed.

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Controlling Slime in Sugar Mills. L. R. BACON, J. V. OTRHALEK and A. L. SOTIER, assrs. WYANDOTTE CHEMICALS CORP., of Wyandotte, Mich., U.S.A. **2,802,757.** 4th September, 1953; 13th August, 1957. The slimes produced by microbial action on stagnant bagasse in a cane mill are treated with an aqueous solution containing at least 200 p.p.m. of an available halogen, i.e. chlorine, in the form of sodium *p*-toluene sulphonchloramine, 1,3-dichloro-5,5-dimethylhydantoin or a hypochlorite of an alkali metal or alkaline earth.

Beet Diffusion. J. B. STARK and A. E. GOODBAN, assrs. U.S. SECRETARY OF AGRICULTURE. **2,801,940.** 11th July, 1956; 6th August, 1957.—Carbon dioxide is added to water used in diffusion so as to neutralize the ammonia entering with returned condensate. The extraction of impurities is thereby decreased and the beet pulp structure improved.

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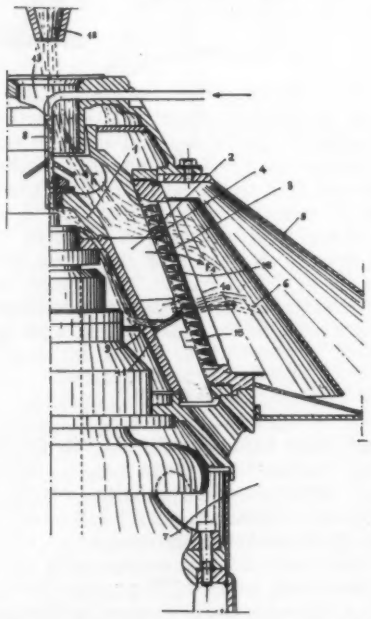
Araban from Beet Pulp. H. S. OWENS and A. E. GOODBAN, assrs. U.S. SECRETARY OF AGRICULTURE. **2,803,567.** 20th February 1956; 20th August 1957. Beet pulp is digested with aqueous lime to liberate araban, CO_2 is introduced into the mixture to adjust the pH to 10–11, and the clear liquor separated. This is further treated with CO_2 to bring the pH to 8–9, the insoluble material separated and the clear liquor evaporated to dryness.

* * *

UNITED KINGDOM

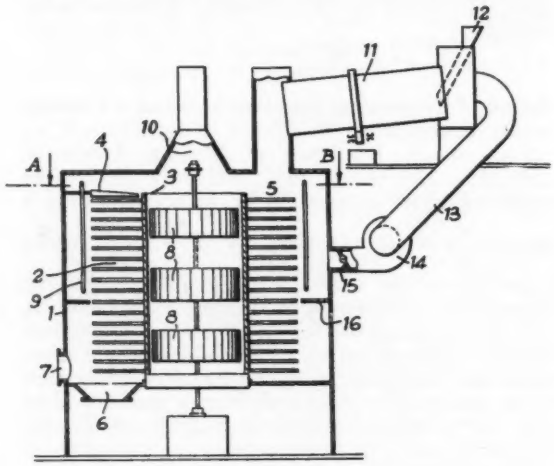
Continuous Centrifugals. CONSTRUCTIONS GUINARD, of Courbevoie (Seine), France. **784,453.** 9th August 1955; 9th October 1957.—Massecuite is introduced into the top of the machine through a nozzle 12 and flows through aperture 13 at the top of the casing in the direction of arrow *F* between the cone 1 provided with scrapers 2 and the perforated basket 3. Molasses passes to the discharge chamber 6 in the direction of arrow F_1, while crystals separated by screen 4 are submitted to the action of scrapers 2 which, owing to their helical shape, move them



downwards in a clockwise direction by virtue of the relative rotation of the cone and basket. A nick 10 in each scraper gives a clearance between the scraper and the basket, and here the crystals collect and form a flattened layer 14. This layer is washed by a series of water jets 9 fed through pipe 8. Continuous arrival of more sugar causes the washed layer to move downwards and so under the action of the scraper again until a further nick zone 15, where the sugar remains in a slow-moving layer for a time which allows it to dry to a greater extent. The crystals are then conveyed by the remaining segment of the scraper to chamber 7 and so out of the machine.

* * *

Sugar Dryer and Cooler. BÜTTNER-WERKE A.G., of Krefeld-Uerdingen, Germany. **784,817.** 7th December 1955; 16th October 1957.—The housing 1 is fitted with a number of annular discs 2 fixed to a rotary frame 3. The discs are formed into segments by radial slots through which sugar is pushed by stripper



devices 4, passing from one disc to the next below and so to the discharge port 6. Cooling air is passed into the housing through the pipe connexion 7 and circulates in the bottom part by means of fan 8. Rising air is warmed by heater elements 9 and dries sugar in the upper part of the apparatus. Some waste air escapes through pipe 10, while the remainder passes into a preliminary drum dryer 11, in which the sugar from the centrifugal is dried to such an extent that it will not cake in the disc dryer 1. Warm air from dryer 11 is returned by pipe 13 and fan 14 and passes into the disc dryer at 15. Fine sugar crystals carried by the returning air stream are deposited in the disc dryer. The plate 16 separates the cooling zone from the drying zone and ensures that the air rising must do so by way of the slots in discs 2.

* * *

Sugar Beet Seed Drill. RAFFINERIE TIRLEMONTOISE, of Tirlemont, Belgium. **789,435.** 22nd June 1956; 22nd January 1958.

TRADE NOTICES

Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

Controlling Sugar Cane Borers in Pakistan. Shell Chemical Co. Ltd., 170 Piccadilly, London, W.1.

Investigations in Pakistan have shown that the generally low percentage of sugar recovery from cane can be attributed to insect damage. The most important pests are top-shoot borers (*Scirpophaga nivella* F.) and stem borers (*Chilo tumidicostalis* Hmps.) and their activities have several adverse results. The yield of cane is depressed, and inversion is induced which leads to poorer quality juice; also the quality and the quantity of the cane fibre is lowered.

On occasions when the cultivators have been unable to prevent insects ravaging their crops, the Government Plant Protection Dept. has arranged for large areas of cane to be treated with insecticides. To do this job swiftly, specially equipped aircraft have been used, fitted with tanks to hold the insecticide emulsion, discharge pumps, and booms carrying nozzles which produce a suitable spray pattern. To control the pests "Endrin" was chosen because it is effective and economic to use.

"Endrin" is a persistent insecticide which is recognised as outstanding for killing caterpillars, and is widely used to control such harmful plantation pests as beetles, froghoppers, leafminers, plant bugs and thrips. This chemical was synthesized in 1950 and since then has been used continuously all over the world on many crops. It is available for sterling or dollars.

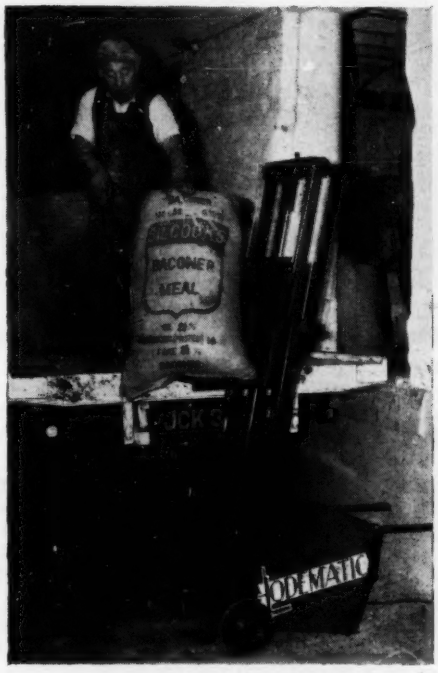
In Pakistan the "Endrin" dosage found effective is 0·2 lb of active ingredient per acre. At this rate the infestation of cane by borers has been reduced from 45 % to 2% by a single thorough treatment. However, to prevent attack throughout the season under local conditions, two or three applications of "Endrin" are probably necessary. This treatment also controls other pests in the sugar cane insect complex, including leafhoppers, lygaeid bugs and white flies.

* * *

Automatic Sack Lifter. Lodematic Ltd., Clitheroe, Lancs.

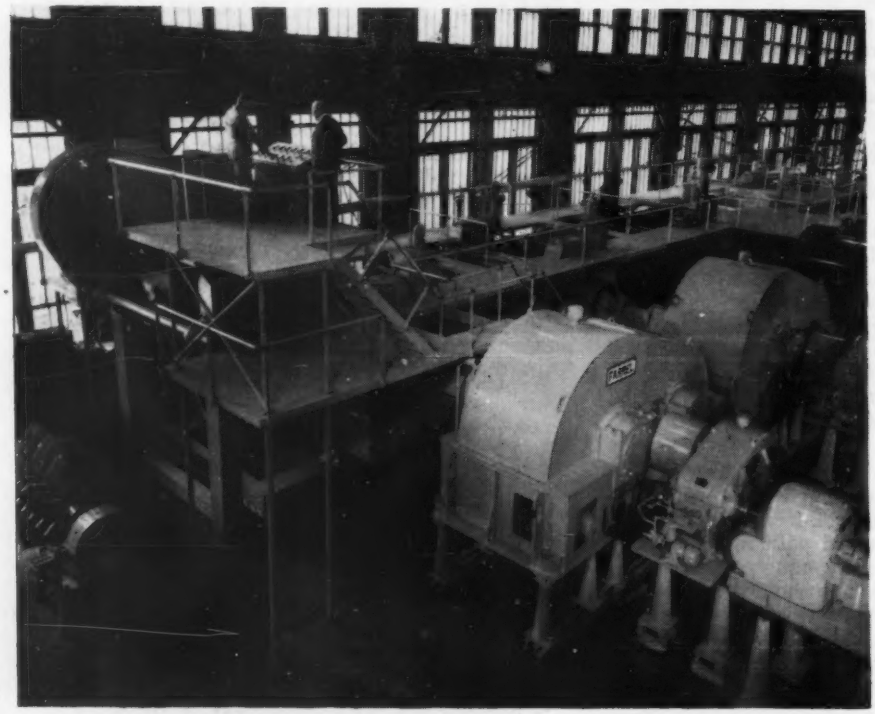
Single-handed sack piling from shoulder height and truck loading are greatly simplified by the new "Lodematic" automatic hydraulic sack lifter illustrated, which can lift and count automatically. Only 24 inches wide and of compact telescopic design, the "Lodematic" pushes alongside truck or stack like a small barrow. On receiving the load the platform lifts, and when unloaded it descends. Sacks fed by hand or sack truck halt automatically at any level for topping, shoulder-height sack piling or truck loading.

The "Lodematic" counts as it lifts, if required, by counter attachment, and the hydraulic system is powered by "plug-in" electric motor. Low weight and telescoped height allow use on upper storage floors, and in confined space. Up to 10 ft lift is available, according to model, so that this pattern can also be used for inter-floor lifting. A manual "over-rider" is provided, and can over-rule the automatic system, and start, halt or reverse the platform at any point.



Up to 12 ft lift on forks or goods platform for inter-floor lifting and high-level loading and stacking is obtainable with the "Lodematic" light-weight straddle stacker. The power-hydraulic system is under finger-tip control of the manual lever, and height of lift and rate of descent are infinitely variable. On release of the lever, the platform automatically halts. The goods platform is 2 ft square, and palletized and other loads up to 500 lb can be handled according to model. A model powered by hand-hydraulic pump is also available for occasional lifting of loads of up to 300 lb.

Free trial of these handy, versatile and low-priced machines can be arranged in the United Kingdom, and in certain countries overseas.



New Farrel Tandem for Central Romana. Farrel Birmingham Co. Inc., Ansonia, Conn.

A new 18-roller 38 × 84 in tandem is being installed at Central Romana, Dominican Republic, to replace a tandem which has passed its usefulness as an economic producer of sugar. It will be installed during the first quarter of 1958 and is expected to be grinding cane for several months of the 1958 crop. The six mills are identical except for roll grooving, which is of progressively smaller pitch to meet customer's specifications. Each is driven through two double-reduction gear drives by an 815 h.p. 4800 r.p.m. Murray steam turbine (capable of delivering a maximum of 1290 h.p. at 5000 r.p.m.), resulting in a normal top roll speed of 67 f.p.m. in order to produce a rated grinding capacity of 7000 tons of cane per day.

Gearing for each individual mill is completely separated and independent from that of adjacent mills. The first two reductions from the turbine are contained in a high-speed double-reduction gear unit, completely sealed, and lubricated by means of its self-contained lubricating oil pump, filter and cooling system. This unit is coupled to a second double-reduction unit, also self-contained within its own gear case, and lubricated by splash lubrication from its own lubricant reservoir in the base of the case. Torrington spherical-roller self-aligning bearings are used within this second reduction case, and are likewise lubricated from the gear lubricant. This drive is so friction-free that it was possible to turn the gears quite freely by hand from the input shaft. The second or final reduction gear unit is coupled to the mill by means of a standard square-sleeve mill coupling, while a Wichita air-operated clutch is used between the two gear units to make this a cut-off point should a mill stoppage occur.

All of the intermediate carriers are of the Farrel patented rubber-belt design, which has been tested and found highly satisfactory in other factories in one or two carriers at each location.

The intermediate carriers are high-sided and of unit-type construction so that they can be lifted out, each as a single piece. Integral with each carrier is a feed roll which assists in providing a uniform and compressed blanket to the cane roll. The feeding chute to the first mill has an underfeed roller as well as a conventional overfeed roller to ensure positive feeding of the cane.

Ahead of the tandem, two sets of Farrel type K-4 cane knives are being installed, the first with 2 in knife spacing and the second $\frac{3}{4}$ in, each driven by a 600 h.p. 600 r.p.m. motor. The centralized control for mill speed and air-clutch control is located for full view of the entire mill operation.

PUBLICATIONS RECEIVED

SMITH SUGAR CANE MILLS. A. & W. Smith & Co. Ltd., 21 Mincing Lane, London, E.C.3.

A new illustrated leaflet, Publication No. SCM.57, describes and illustrates features of the Smith kingboltless-type of cane mills, which range from 40 in × 84 in units to 8 in × 12 in. Milling plants manufactured during 1957 include two for Pakistan and one each for South Africa, Mexico and Mauritius, while plants under construction include one each for Mexico, South Africa, India, Jamaica and Mauritius.

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Fletcher Mill for Brazil. George Fletcher & Co. Ltd., of Derby, have recently received an order for a complete mill tandem for Estacao de Itaiquara in Brazil. The tandem will be an 18-roller unit, 26 in × 48 in, with independent electric motor drive, and is to handle 1500 long tons of cane per 24-hour day.

* * *

Stewart Beet Diffuser Contracts. Duncan Stewart & Co. Ltd., who have since 1950 installed nine R.T. Continuous beet diffusers for the British Sugar Corporation Ltd., have received orders for two further units, one of 3000 tons per day capacity for Kidderminster, and the other of 4500 tons per day capacity for Ely factory. The latter will be the largest single continuous beet diffuser so far manufactured in the world.

Cuban Sugar Exports[1]

(Spanish long tons).

	January/December		
	1957	1956	1955
NORTH AMERICA—			
United States*	2,683,303	2,692,401	2,476,775
United States for refining and export	10,237	37,358	21,365
Canada	91,992	84,400	73,910
SOUTH AMERICA			
Bahama Islands	—	580	—
Bolivia	1,038	—	—
Chile	40,445	38,646	63,174
Costa Rica	—	9,420	—
Mexico	—	49,216	—
Dutch West Indies	826	—	188
Honduras	4,578	3,156	3,203
Uruguay	31,820	44,978	—
Venezuela	—	188	1,644
Jamaica	211	—	—
Bermuda	1,311	1,041	1,335
Other Countries	47	—	—
AFRICA—			
French Morocco	181,758	124,409	115,365
Canary Islands	7,059	—	30,871
Spanish Morocco	—	32,118	12,490
Tangier	1,765	779	1,039
Tunisia	3,007	—	—
ASIA—			
Hong Kong	—	—	19,711
Indochina	—	3,669	17,398
Iran	4,687	60,954	51,114
Israel	15,786	37,719	35,191
Iraq	7,385	—	—
Korea	—	—	4,795
Lebanon	13,750	47,047	46,211
India	—	—	10,874
Pakistan	31,094	44,254	10,114
Syria	20,541	37,003	19,567
Ceylon	8,122	28,985	63,619
Guam	127	71	71
Jordan	5,275	—	—
Tahiti	323	167	2,705
EUROPE			
Belgium	9,532	15,345	5,681
Finland	—	26,055	31,776
France	96,959	124,871	57,428
Greece	28,802	39,885	48,219
U.K.	411,363	370,449	120,338
Holland	145,283	95,397	156,461
Eire	9,465	—	34,105
Iceland	3,959	6,590	3,557
Hungary	—	18,718	—
Italy	8,667	—	1,582
Vatican	—	727	1,246
Yugoslavia	20,878	8,969	28,155
Norway	—	3,954	—
Portugal	9,679	344	330
Spain	22,196	—	—
Sweden	15,388	74,872	47,517
Switzerland	7,482	18,154	16,034
Trieste	—	—	540
West Germany	373,197	178,020	120,984
East Germany	6,706	22,429	—
Austria	10,676	55,029	10,157
U.S.S.R.	347,673	206,351	442,914
Czechoslovakia	—	5,063	—
Total Exports	5,140,673	5,235,074	4,507,080
Thereof to world free market	2,459,037	2,542,673	2,030,305

*Hereof 1957 : 1,667, 1956 : 2,341, 1955 : 9,404 Span. long tons for feeding purposes, not chargeable against U.S. Quota.

French Sugar Imports and Exports[2]

(metric tons)	1957		1956	
IMPORTS	Unrefined	Refined	Unrefined	Refined
French Possessions	344,899	—	242,763	—
Cuba	115,587	15,785	99,461	5
Peru	5,069	—	1,283	—
Argentina	15,521	5,086	—	—
U.K.	5,563	—	—	—
Italy	6,191	5,000	—	—
Venezuela	—	25,211	—	—
Other Countries	909	226	169	156
	439,739	51,308	343,676	161
EXPORTS				
French Possessions	205,808	200,494	176,004	174,306
Ethiopia	—	280	4,750	444
Libya	—	—	1,926	—
Holland	—	—	65,367	—
Sudan	—	—	7,422	—
Switzerland	2,515	69,905	11,142	83,186
United Kingdom	500	—	—	—
Hong Kong	—	—	1,100	—
Jordan	—	—	1,900	—
Western Germany	4,945	5,750	8,386	540
Saudi Arabia	—	—	9,250	35
China	—	—	25,520	—
Ghana	—	3,048	—	1,297
Finland	—	—	5,680	—
Greece	—	—	5,104	257
Italy	120	7,416	2,790	5,240
Pakistan	—	—	3,286	—
Belgium/Luxembourg	11	80	545	—
British East Africa	—	9	30,508	—
Jugoslavia	10	—	17,708	—
Nigeria	—	1,745	—	1,214
Lebanon	—	41	2,080	50
Tangier	—	266	5,590	255
British West Africa	—	61	—	2,879
Viet-Nam	—	—	1,010	43
Other Countries	84	862	1,785	1,945
	213,993	289,997	396,354	271,741

Flooding in Mozambique.[3]—The Zambesi river burst its banks, flooding large areas of sugar cane and threatening thousands of cattle on Sena Sugar Estates land near Luabo. Some 1200 acres were flooded when the Kunkue river, a tributary of the Zambesi, overflowed its banks at Marromeu.

* * *

Japan Sugar Statistics, 1957[4].—The total melt during 1957 amounted to 949,302 metric tons yielding 898,864 tons of sugar, tel quel, including 643,439 tons of refined white soft sugar. Stocks at the end of December totalled 136,042 tons, including 114,806 tons of raws, 20,316 tons of refined and 1280 tons of other sugars.

* * *

Tanganyika Developments[5].—The Tanganyika Government has granted an exclusive licence to the Tanganyika Sugar Co. Ltd. to investigate the suitability of certain parts of the Kilombero Valley for sugar production on a fairly large scale. The Company has announced its intention of opening up the land and gaining experience before starting tenant farmer schemes for the encouragement of Africans to grow sugar cane in the area. It is expected that the first crop will be ready in 1960 with a probable yield of about 25,000 tons a year.

[1] F. O. LICHT, *International Sugar Report*, 1958, **90**, (Supp.2), 8.
[2] *G.N.I.B.C.* ; through C. Czarnikow Ltd., *Sugar Review*, 1958, (342), 39.
[3] *Public Ledger*, 8th March, 1958.
[4] *Willett & Gray*, 1958, **82**, 80-81 ; F. O. LICHT, *International Sugar Rpt.*, 1958, **90**, (Supp. 4), 14.
[5] *Overseas Review* (Barclays D. C. & O.), March 1958, 41.

BREVITIES

Corrosion Prevention in Ammonium Nitrate Drums[1].—Use of ammonium nitrate as fertilizer is limited because its explosive nature in the solid state prohibits transport in this form, and because it is corrosive in solution and attacks the conventional steel drum. Addition of aqueous ammonia to the ammonium nitrate solution, however, has been found to prevent attack, both above and below the liquid level.

* * *

Taiwan Sugar Exports[2].—Exports of centrifugal sugar by Taiwan during 1957 amounted to 827,429 metric tons, tel quel, equivalent to 857,000 tons, raw value. In addition, 16,666 tons of low grade sugar was shipped. Destinations were as follows :

	Centrifugal	*Non-Centrifugal*
Japan	329,643	12,626
Malaya & Singapore	82,550	500
Middle East	227,644	—
Other Asia	163,622	3,540
East Africa	21,700	—
U.S.A.	2,270	—
	827,429	16,666

Stock Exchange Quotations

London Stocks (*at 18th March* 1958)

	CLOSING MIDDLE
Anglo-Ceylon (5s)	12/–
Antigua Sugar Factory (£1)	20/6
Booker Bros. (10s)	17/–
British Sugar Corp. (Ltd. (£1)	14/3
Caroni Ord. (2s)	4/–
Caroni 6% Cum. Pref. (£1)..	17/3
Distillers Co. Ltd. (6s. 8d units)	19/9
Gledhow Chaka's Kraal (£1)	54/6
Hulett & Sons (£1)	63/–
Jamaica Sugar Estates Ltd. (5s units) ..	5/4½
Leach's Argentine (10s units)	6/4½
Reynolds Bros. (£1)	46/9
St. Kitts (London) Ltd. (£1)	48/9
Ste. Madeleine (Ord.) (£1)	25/6
Sena Sugar Estates (10s)	26/3
Tate & Lyle (£1)	50/7½
Tate & Lyle Investments Ltd. (5s)	9/–
Trinidad Sugar (5s stock units)	7/10½
United Molasses (10s stock units)	27/–
West Indies Sugar Co. Ltd. (£1)	27/6

New York Stocks (*at 17th March* 1958)	CLOSING MIDDLE $
American Crystal ($10)	32⅞
Amer. Sugar Ref. Co. ($100)	28½
Central Aguirre ($5)	19
Cuban American ($10)..	21¼
Great Western Sugar	22⅛
South P.R. Sugar	27¼
United Fruit Co.	41⅛
West Indies Sugar Corp. ($1)	59½

Cane Harvesting Scavenger[3].—A new H.S.P.A.-designed machine traverses cane fields after grab harvesting, picking up small cane which has been left. This it does with 95% efficiency after two passes, covering about 1 acre per hour. The machine operates on the "star wheel" principle, and cleans in swathes of 10 ft, hauled by a tractor.

Rear view of the pick-up unit, showing the ten independently-oscillating star wheels which throw short pieces of cane on to the conveyor. The central collecting bin is being discharged.

* * *

Hawaii Sugar Dispute[4].—Demands for wage increases of 25 cents per hour, coupled with increases with automatic promotion for certain workers, are estimated to require $12·5 million per year. This demand by the union is considered unrealistic by the managements, in view of low and falling profits, and the resulting strike could not be averted by Federal mediators called in by the Governor. The Aiea and Crockett refineries of California and Hawaiian Sugar Refining Corp. have been shut down as raw sugar stocks became exhausted, but the California refinery is expected to start working imported raws later this year.

* * *

Cuban Refined Sugar Subsidy[5].—To make Cuban refined more competitive in world markets, the ICEA are reported to be granting a further allowance in addition to last year's 20-point allowance on purchases of raws it holds in stock for sale. Sellers of refined may now ask for 30 points off the average spot price for the five preceding days or they may request a deduction from their refined selling price of 105 or 115 points, depending on whether the sugar is in jute or cotton bags.

* * *

Dominican Republic Sugar Authorisation.[6]—The total tonnage of sugar authorised for production during the 1958 season has been fixed by Presidential decree at 999,000 short tons, equivalent to 906,287 metric tons. The distribution of this amount is as follows (in metric tons) :

Free market export quota	655,000
U S. quota	50,248
Total export quotas.....	705,248
Local consumption	65,015
Obligatory reserve according to Article 13 of the Int. Sugar Agreement....	65,500
Voluntary reserve	70,524
Total reserves	136,024
Grand Total	906,287

[1] *Sugar News* (Hawaii), 1957, **7**, (12).
[2] C. Czarnikow Ltd., *Sugar Review*, 1958, (345), 52.
[3] *Sugar News*, (Hawaii), 1958, **8**, (1).
[4] *Sugar News* (Hawaii), 1958, **8**, (1).
[5] F. O. LICHT, *International Sugar Report*, 1958, **90**, (Supp. 4), 5.
[6] F. O. LICHT. *International Sugar Report*, 1958, 90, (Supp. 5) 9.